

## **Engaging people in managing natural resources**

**(Biodiversity Documentation Process and Information Systems)**

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### **Part I - Understanding Biodiversity**

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Dedicated to

Our brethren with roots deep in Indian soil and  
who taught us much that has enabled us to write this.

### Overview

Rapid changes in the environment pose a huge challenge to the world today. On this hot and angry earth, we should leave the beaten track and seek new ways of managing our affairs that may seem difficult, but is essential that we transform the present systems of economy, social and governance. The first disaster facing the world is global warming. Scientists all over the world have agreed that human interference is the main reason for the rise in temperature after 1950. As the Himalayan glaciers are melting before our eyes and the temperature of the Arabian Sea is rising, severe cyclones Nisarga on June 3, 2020 and Taukte on May 17, 2021 hit our west coast. Another challenge facing the world is the ongoing loss of biodiversity. It is acutely felt all over India, particularly in the biodiverse Western Ghats, Eastern Himalayas and the hill ranges of Meghalaya and adjacent Northeast India. In order to face these two challenges, two agreements on climate change - Convention on Climate Change (CCC) - and Biodiversity - Convention on Biological Diversity (CBD) were adopted at the 1992 Rio de Janeiro Earth Summit.

Conservation of biodiversity, sustainable use and equitable distribution of benefits are key objectives of CBD. The conference recognized the importance of the knowledge and traditions of local communities and decided that such communities should be given an important role in the pursuit of CBD. India promptly ratified the decisions of this conference and took up the process of

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drafting a National Biodiversity Act to implement its objectives. In 1998, a committee was constituted under the chairmanship of Dr M.S. Swaminathan to draft this Act. As a member of the committee, I, Madhav Gadgil presented before the committee the Biodiversity Registration Plan developed from various experiences. This concept was accepted after extensive discussion and the Act provided that all the local self-government bodies in urban and rural areas should establish Biodiversity Management Committees to manage biodiversity.

The then Union Minister of Environment took a progressive step to disclose the draft law and after public debate the Biodiversity Act was passed in 2002. The objectives of the act are conservation of biodiversity, its sustainable use and equitable distribution of benefits. The Act explicitly states that “ Every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and micro organisms and chronicling of knowledge relating to biological diversity.” The scope of biodiversity is thus not limited to plants. There are aquatic animals in the sea and river, there are crops grown in agriculture, horticulture, flowers, fruit trees. It includes domesticated livestock, and very importantly a variety of habitats in the nature. The Biodiversity

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Management Committees are explicitly empowered to manage this whole range of biodiversity along with their habitats.

An authority has been set up at the national level for the implementation of this Act. In many states, state level Boards have been established. But as mentioned above, as per this Act, it is mandatory to form Biodiversity Management Committees (BMC) in all local self-government bodies, i.e. Gram Panchayats, Taluka Panchayats, Zilla Parishads, Municipalities and Municipal Corporations. These local level bodies have the power to manage the biodiversity in their area, to allow or deny outsiders the use of biodiversity in their area, to charge collection fees if permission is granted and to accept grants. Such grant may also be in the form of nature conservation service charges. Apart from biological resources, the Act also aims to manage knowledge related to biodiversity. Just as the Local biodiversity committees can control the use of biological resources by the outsiders, they can also control the registration and use of relevant knowledge by the outsiders. Collection charges may also apply for this. The National Biodiversity Authority can regulate all patents and similar intellectual property rights. It is the duty of the Authority to approve applications for patents using any knowledge relevant to life form in India and to arrange for a fair share of dividends to the Indian holders of such knowledge while granting such approval. While doing this the Biodiversity Act also provides that further steps will be taken in consultation

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with all local Biodiversity Management Committees. So far many committees like Joint Forest Management Committees, Watershed Management Committees have been established at the level of Gram Panchayats or their constituent village level. These are established or abolished at the whim of related government departments. On the contrary, the Biodiversity Management Committees will be established everywhere as per this Act and no permission or registration of any department will be required for their establishment. These committees can open their own Biodiversity Funds. For that a bank account will be opened and the transaction can be done through it. For these many reasons, it is hoped that these committees will be able to function more robustly.

It is also expected that such Biodiversity Management Committees will continue to collect site and time specific information about these biodiversity habitats and all types of species in the form of People's Biodiversity Register every year and this information will be stored in a well organized database using modern information technology. Not only will this information be used to manage biodiversity, but it can also play an important role in monitoring impacts on the environment. Lack of such information today leads to misrepresentation of environmental impact assessments, which will be prevented by this information. Also, this information can be used for better planning at district level. Based on this information, claims for registration of local varieties

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can be made and grants can be obtained from the "Protected Varieties of Crops and Protection of Farmers' Rights Authority" for their preservation.

Unfortunately, the government system is not at all interested in empowering the people by handing over proper powers to them. This was essential as per the principles of the CBD, yet in 2004, the government promulgated completely arbitrary regulations in complete disregard of these principles. As per these regulations, BMC has no role in the management of biodiversity and habitats. The BMC now makes inventory of local flora and fauna, record traditional knowledge related to medicinal and other uses besides preparing the list of traditional healers. The BMC will still prepare and validate biodiversity registers. They also have the right to collect collection fees for using resources and knowledge. An important issue in this regard is that if public knowledge is recorded and published by these committees, how to be ensure that this will not be used illegally ? Biodiversity Register is the property of the concerned BMC and they have the right to decide which information should be made public. In particular, these committees should decide not to disclose information on medicinal and other commercially important uses of biodiversity. But there is no scope for this in today's rules. India is committed to acting on the principles of CBD; so we should set aside these wrong rules and make proper rules by following the original law. It will take time, but there have been some positive experiments adhering to the original law despite the

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complete discouragement of government agencies and other vested interests.

Among them, the experience of Kadnad in Kerala is remarkable.

On 16 October 2021, Kuttikkal in Kottayam district of Kerala was hit by floods and landslides, causing the worst damage and killing 14 people. People here have been suffering from stone quarries for more than a decade; they are clamoring for shutting them down. In Kadnad, 25 km from Kuttikkal, proper information was collected and an attempt was made to deal with this crisis on the basis of it. The Kadnad Gram Panchayat on 10 May 2011 resolved that no major construction can be done without the consent of the Panchayat and the local Biodiversity Management Committee. After this, the local Biodiversity Management Committee prepared a People's Biodiversity Register and requested the Kerala State Biodiversity Board (KSDB) to examine the information in the register and make an Environmental Impact Assessment of the stone quarry and stone crusher. Pursuant to this request, KSDB appointed a team of experts on 24 December 2011 which confirmed the information in the Gram Panchayat's People's Biodiversity Register. In 2012, the Kerala High Court gave a ruling that strong evidence was presented against the stone quarry and that it should not be granted permission. The High Range Defense Committee, which was against denying such permission, campaigned that the area of Kadnad panchayat would now be declared as a sensitive zone and the panchayat would be in the clutches of the forest department. As a result of this



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propaganda, the panchayat cancelled the earlier decision. A young man from Kuttikkal village came to interview me with a TV crew three days after the October 16, 2021 tragedy. He was disturbed as there was great anxiety as the common people were completely helpless.

In today's age of knowledge, possibilities of such more vigorous positive efforts are increasing. Now it is getting difficult keep the people confined to darkness of ignorance. We had a very encouraging experience in this regard. Dr. Vijay Edlabadkar and I are working for some years with a group of select active youths coming from villages which got Community Forest Rights in Gadchiroli district. All the team members have smartphones and we created a whatsapp group for mutual communication. In CFR Management Plans, scientific names of plant species from which minor forest produce is obtained must be included. Young people rooted in the soil have a great curiosity in general about these species and the different flora and fauna around them. They know the Gondi and often Marathi names of the hundreds of such species. During the training they had learnt what biological names are and their importance in accessing a wide range of information. They have become adept in doing Google searches, searching the Internet for information about market places and searching Wikipedia for information about the minor forest produce species, especially their commercial uses in the world. Also they learnt to download new apps and upload them in their smartphone.

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These youths were constantly uploading pictures of plants and animals in their area on the WhatsApp group, and sharing their experiences about them. Although I am familiar with many of their flora and fauna, I am no expert on taxonomy. So I deliberately invited a plant taxonomist of my acquaintance to join our group; I was very hopeful that he would tell us the scientific names of those plants. But like the Sanatana Pandits he did not want to give up his hold on knowledge and was of no help. Then one day I was amazed as one of our group members Saduram Madavi started giving the scientific names of the species along with the photographs. I started checking his information by reading the Wikipedia article and was pleased to find that he was almost never wrong. I myself had never used the apps Google Photos - Google Lens, but Saduram discovered these apps on his own. Google has its own database of billions of photos. When someone uploads a photo using Google Lens, the database compares it using artificial intelligence and immediately provides the most probable English and scientific name to the person who took the photo. As more people take photos using their app, this database gets richer. Google needs to keep growing its own knowledge base, as it attracts more users and earns more revenue from advertising and other financial transactions. Saduram is a very clever and intelligent young man. But he could not even pass the 10th standard due to poor facilities of education and hurdle of English language. But in the modern age of knowledge, all these difficulties can be

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surmounted and he has now started to take advantage of the modern knowledge base brushing aside the monopoly of the highly educated people. Recently, he has taken a step further and started adding to the scientific knowledge base himself. An attractive orchid, Zharka in Gondi language, growing on the ground in the vicinity of his village, caught his eye. Using Google Photos and Lens, he discovered that the orchid's scientific name is *Geodorum laxiflorum*. A few botanists from the college in Gadchiroli became his friends, attracted by his knowledge of plants. When they went through the published literature they realized that this is the first record of *Geodorum laxiflorum* from Gadchiroli district. Then they studied further and published a research paper in the scientific journal “Journal of Threatened Taxa” with Saduram as a co-author. Thus Saduram has now become a formally recognized scientist. This is a very important step towards building an egalitarian and enlightened humane society.

It has been fifteen years now since the initial publication of the book “Nisarga Nijyojan Lok Sabhagane”. We have prepared this new revised edition, taking into account all the experiences since then, and using the new tools of the knowledge age to outline how biodiversity inventory can be done with the participation of an increasingly enlightened public. We strongly hope that the people of India will step on the path of progress with renewed vigor using this newly developed system.

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### 1. Biodiversity current Scenario

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### 1.1 Man and Nature

Trees and creepers are our kins! The birds, they sing melodiously!

Sky is our pavilion, earth our seat! Our mind revels in this setting!

- Saint Tukaram

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In India today it is in the tribal lands that nature is most bountiful.

Sadly, the human communities coexisting with this wealth of nature are afflicted by poverty and malnutrition. Clearly, we must transform the system that has created this equation of riches of nature with deprived human communities. Of course, we must conserve, and, indeed, rejuvenate nature; but surely not by treating our own people as enemies. The many different components of our own society and our system of governance are undoubtedly inflicting wounds on the natural world today. So, all of us must learn to deal with natural resources in a disciplined and prudent manner. But this cannot be achieved merely through imposing restrictions on communities living close to nature. After all, such communities do have a greater stake in the health of the environment. However, it is only in exceptional cases that local people are today taking good care of the natural world. This is because, beginning with the British times, people have been deprived of all rights over natural resources, and these have been dedicated, initially to meeting colonial



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demands and lately to serving the industrial and urban interests. We have made available to plywood industry giant naturally growing Appimidi mango trees, which yielded fruit famous for pickles worth hundreds of rupees every year, for as little as sixty rupees. Such perverse incentives to industry have destroyed people's motivation for guarding nature.

Fortunately the tide is turning. Joint Forest Management, Extension of Panchayat Raj to Scheduled Areas, Protection of Plant Variety and Farmers' Rights Act, Biological Diversity Act and the Scheduled Tribes and other Traditional Forest Dwellers (Rights over the Forest) Act have conferred substantial rights over natural resources to local communities. Along with the rights, of course, comes the duty, the responsibility of using this natural wealth prudently, in a sustainable fashion. At the same time the National Rural Employment Guarantee Scheme has opened up opportunities to earn a livelihood, while protecting nature, and rejuvenating natural resources. If we employ the provisions of all these various acts in an integrated fashion, it is surely possible to accomplish a great deal.

Keeping people out of the reserve forests, wildlife sanctuaries and national parks has become an article of faith, regardless of whether it serves the cause of wildlife or more broadly biodiversity or not. A striking example of the incalculable damage that may be inflicted by thus unthinkingly treating

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people as enemies of nature comes from the story of the notorious ivory and sandalwood poacher Veerappan. His gang operated unchecked for full 20 years on the forested hills bordering Karnataka and Tamilnadu, while they indulged in murdering several Government servants. They killed an estimated 2000 tuskers, and wiped out all well grown sandalwood trees. They could inflict such devastation with impunity because local people were totally un-cooperative with the Government machinery, which they saw as bent only on harassing them while Veerappan gave them some sorely needed employment.

Even so knowledgeable a scientist as Dr. Salim Ali subscribed to this perspective out of sheer prejudice. The Bharatpur wetlands, famous for the large heronries in the rainy season and the enormous flocks of migratory birds visiting in winter, was one of the first wildlife sanctuaries to be created after independence at the instance of Dr Salim Ali in the 1950s. He had worked for years at Bharatpur, banding thousands of migratory birds.

Bharatpur had been subject to grazing by buffaloes and other uses such as collection of khus grass by local people for centuries, and had remained a biodiversity rich habitat teeming with waterbirds. However, Dr Salim Ali felt that the habitat would greatly benefit from a cessation of buffalo grazing and was supported by experts of the International Crane Foundation. These recommendations led to the declaration of the locality as a National Park in 1982. The rigid regulations applicable to a National Park called for total

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cessation of livelihood activities of local people, so buffalo grazing was banned without any alternatives being offered. There were protests; seven people were killed in the firing that followed, but the ban was enforced.

This intervention led to a totally unexpected outcome. It turned out that buffaloes were keeping under check a water loving grass *Paspalum*. When grazing stopped this grass grew unchecked, rendering the wetland a far worse habitat for waterfowl, the prime objective of the National Park management. The numbers of visiting Siberian cranes have also been declining. Residents of the village Aghapur adjoining the National Park have an intriguing suggestion in this regard. They believe that Siberian cranes earlier had better access to underground corms and tubers, their major food, because the soil used to be loosened while digging for khus roots. Since this collection was stopped on declaration of National Park, the soil has been compacted reducing their access to this food. This is a plausible hypothesis worth exploring further.

Why did this happen? This is because even the best scientists have assumed that the local people, whether farmers, herders, fisherfolk or forest dwellers are enemies of nature without undertaking any scientific investigation exploring this issue. We are now starting to set aside this thoughtless and baseless equation.

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It is certain that different elements of the society cause harm to nature in different ways. Industries, cities, towns are the major contributors causing this harm. The agricultural villages, not close to forest area, through their modern practices involving pesticides, heavy doses of fertilizers and too much of irrigation also contribute in this harm. It is therefore necessary that all sections of the society need to use natural resources in a disciplined and prudent manner. Industries, urban population and modern agriculture will have to make amends in the use of natural resources besides spoiling it with their refuse. This will not be achieved by simply imposing restrictions on the local people in the forested area. This is because the interests of local people in the forested area is more closely linked with nature conservation than any other section of the society. If the right framework is created, these people will recognize their interests and use their traditional and experiential knowledge to make a strong contribution to the conservation of nature.

### 1.2 Knowledge based management

The big challenge before us is to conserve natural resources and at the same time to use them for the development of marginalized people in the area. If this is to be achieved, then we have to plan our management of natural resources in a completely new way. So far, this planning has been

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done on the basis of scanty data and in a manner often influenced by vested interests. Calling it a scientific forest and wildlife management is completely misleading. Science is grounded in on reliable information about the objective situation whereas the forest managers have no such information. At one time, the forest department was not sure whether it owned 6.9 crore hectares of land or 7.5 crore. When the forest cover of India was scrutinized on the basis of satellite imagery, it was found that the figures given by the forest department for the areas under different types of forest were totally wrong. In 1980s there was a plan to plant tropical pine trees in Bastar replacing the existing cover on a massive scale. Adivasis were vehemently opposed to such destruction of the natural forest which was beneficial to them in many ways. A committee was then appointed to look into the matter. The committee found that the experimentally planted pine plantation in Bastar, on the basis of which it was claimed that this species can flourish in Bastar, was hardly in existence and no information was collected regarding the pine growth. In 2002 it was brought out that when the tiger population in the Sariska Tiger Reserve was officially given as 17, not a single tiger was in existence.

### 1.3 Time and locality-specific planning

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On the basis of such meager misinformation the management of India's natural resources has been going on for the last one and a half centuries, doing injustice particularly to the local people in the forested area. In its place today, it is

necessary to nurture nature on the basis of systematic information, with the participation of all sections of the society, looking at the trends in natural resources and adapting to them. This requires careful, timely and site dependent planning. Recently, scientific understanding of complex natural systems that vary a great deal depending on time and locality has progressed considerably, especially in the context of the study of climate.

Consider as an example the forest ecosystem. The plant species on a mountain plateau will not be found on the slope of the same mountain, and may not be found on a neighboring mountain plateau. The flowers that bloom at the beginning of the rainy season are different from the flowers that bloom in the rainy season itself. An insect infestation that occurs in the forest this year could be very different from that in the next year. Mango trees bear a lot of fruits in one year and in other year there will be little yield. Moreover, the relationship between human society and nature also changes with time

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and place. In one village, a specific plant is used as medicine on diarrhea , while in another, it is quite different plant. In one village, horticulture provides a lot of fuel, while the people of a neighboring village depend on the forest for firewood. At the beginning of the rainy season, people catch fish which is moving upstream for reproduction, while at the end of the rainy season, they eat tubers from the forest.

Glaring examples of relationship change between human society and nature with time is found in most of the towns and cities. Bengaluru was founded by Nadaprabhu Kempegoda, the 16th century chieftain who developed 1000 lakes in the city to cater to its drinking and irrigation needs. Today, a large number of the lakes have disappeared due to dumping of debris or solid waste and those which survived get discharge of city sewage from the surrounding localities and have become highly polluted. Most of the industries all over, pour their highly polluted effluents into nearby waterbodies including the sea.

### 1.4 Cooperation for mutual benefit

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Pluck the flowers only as a gardener does.  
Don't cut the tree along with its roots as a charcoal maker does.

- Mahabharat

If you want to use the resources properly, you have to consider all these details. The interdependence of human beings among themselves and the relationship between man and nature should be taken into consideration. Experience of thirteen Gond tribal villages in the Chhapara block of Shivani district in Madhya Pradesh is worth noting. A lot of Chironji grows in the forests around these villages. But the lack of trust in each other and with no thought of cooperation, people used to collect the fruits indiscriminately before they are ripe. There used to be a mad rush for collecting them before someone else grabs them! When the people of these thirteen villages came together for joint forest management three years ago, they decided that they should harvest Chironji with restraint. According to Gond tradition, Chironji should not be harvested till *Akshayya trutiya* i.e. the second week of May - till it is ripe. They revived this tradition. On doing so, their Chironji income increased by thirty percent that year!

Pani Panchayat movement conceived and started by Vilasrao Salunke in the rural area of Pune district way back in 1972 was based on sustainable, equitable and integrated water management (surface and groundwater) by the local community to stabilize and enhance the agriculture



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- based economy and provide productive employment in the rural area. After the disastrous drought of 1972, Vilasrao Salunke was able to convince and motivate farmers of Naigaon village of the drought-prone Purandhar taluka of Maharashtra, to collaborate in harnessing their water resources to protect from future drought situations. Since then, village watershed development has been the prime focus of Gram Gaurav Pratishthan, a non-profit organization.

### 1.5 Scientific methodology

Of course, the official natural management pretends to be scientific by adopting certain systematic procedures such as of Detailed Project Reports for River Valley Projects or Forest Working Plans or Urban Development plans. But, science is not merely a matter of systematic procedures. Much more importantly, it is a system of continual open scrutiny. How far the supposedly scientific management of environmental resources such as forestry departs from this ideal became evident to one of us (MG) while attending a meeting in early 1980s in Kolkata, presided over by the Finance Minister of West Bengal to discuss environment and forest issues. During the course of this meeting, the head of the forest department asserted that working plans are technical documents that must never be made available to general public. In such absence of openness,

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we continually encounter problems such as the highly inflated estimates of bamboo stocks, or the false claims of the numbers of tigers in Sariska and Goa. (Prasad and Gadgil, 1981; Tiger Task Force, 2005). Similarly, EIA reports for Iron ore mining in Goa were found to be fudged ( Down to Earth report, 15 Dec. 2013).

In consequence, there are several serious short-comings in management of scientific information relating to Indian environment. These include:

Generating and managing information under false pretenses: As a striking case of false pretenses at being scientific, consider forest and wildlife management systems. These exercises are not grounded in good empirical data or sound logic, they do not encourage public scrutiny, and they do not attempt to verify the predictions made. Forest management decisions have often been taken without adequate empirical evidence. Thus, preservation plots, established to measure growth rates of diverse tree species of Indian forests in early 1900's have been mostly destroyed; little data has been collected (Gupta, 1981). Large scale plantations of Eucalyptus were propagated in high rainfall tracts of Western Ghats by clear cutting rain forest without adequate trials. Realized productivities of these plantations, seriously affected by fungal diseases, were 1-3 tonnes/ ha/ yr as opposed to projected productivities of 14-28 tonnes/ ha/ year (FAO, 1984; National Commission on

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Agriculture, 1976; Prasad, 1984). The modern scientific method has been termed as the “hypothetico-deductive” method. Hence, a truly scientific enterprise would treat documents such as “Forest Working Plans” as scientific documents to be made available for peer review by all interested parties, not as official secrets. The yields expected to be realized, and the stocks expected to be left behind after the harvests would be treated as hypotheses to be tested. If the yields do not materialize, or the stocks are not sustained, then a scientific enterprise would acknowledge that there are obvious errors of fact or logic, and attempt to look for and correct them. It would also try to bring on board all interested parties, technical experts, as well as other stakeholders from the civil society, in the effort to understand the mistakes and correct them. None of this has ever been practiced. Because of these serious scientific deficiencies, a study of Forest Working Plans reveals that nowhere in India have the forest resources been utilized in a sustainable fashion. Instead, there has been a universal pattern of sequential overexploitation (Gadgil and Guha, 1992). For instance, Working Plans of Quilon Division in Kerala successively converted Protection Circle into Selection Felling Circle and then into Clear felling Circle as the forest resources of ever steeper slopes were exhausted (FAO, 1984). In 1980, the Forest Conservation Act was enacted and commercial use of Indian forests reduced only following exhaustion of supplies

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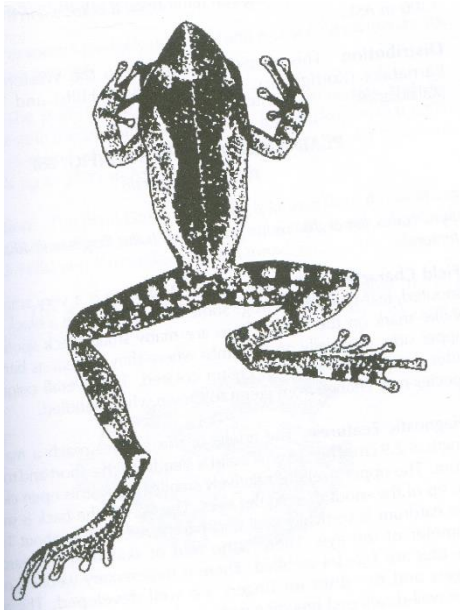
from Indian forests and beginning of large scale imports (Gadgil and Guha, 1992).

Wildlife and biodiversity conservation efforts, too, have not been focused and have not been securely grounded in scientific understanding. Without adequate scientific evidence it has been assumed that subsistence uses by local people are necessarily detrimental from a conservation perspective. On the contrary, shifting cultivation over millennia is probably responsible for enriching India's biodiversity by promoting evolution of hard ground race of Barasinga (*Rucervus duvauceli*).

Deliberate falsification of data: There are many examples of quite deliberate falsification of data. The forest based industries were vigorously promoted in early years of independence. These included paper, plywood, polyfibre and the matchstick industry. One such paper mill was set up in Dandeli in Uttara Kannada district of Karnataka in 1958. At the time it was established, the Forest Department had assessed that the bamboo resources of Uttara Kannada district would provide the raw material for the paper mill in perpetuity. However, the raw material was, in fact, exhausted within a decade. Field studies by the Indian Institute of Science, Bengaluru showed that this was partly due to the fact that the figures for the availability of the bamboo stocks had been grossly exaggerated, by as much as a factor of ten times (Prasad and Gadgil, 1981).

### 1.6 Experimentation

The modern scientific management accepts that every step taken is an experiment. The next steps are decided by carefully observing the results of such individual experiments. In order to make such an adoptive scientifically sound management, it is necessary to collect information about the details of living beings everywhere, and not just once, but continuously.



But that doesn't happen. Take the example of Bharatpur. Although there was no strong evidence that buffalo grazing caused damage to waterfowl and their habitats, grazing was stopped. It soon became clear that the opposite was true. The buffalo's grazing were benefiting the ducks and the tank. Even so, till the date- for last 38 years

- ban on the grazing continues. Stubbornly doing something has become the hallmark of this management system. On the contrary, science today says that planning for the environment should be done on the basis of constant observation and making changes as required. This is termed as adaptive management. Had we followed this method, grazing of buffaloes would not

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have been stopped everywhere in Bharatpur. The effect would have been studied by enforcing ban in some selected areas. In this study, if the ban on grazing would have been found to yield good results, then grazing would have been stopped in more areas. On the contrary, if the ban on grazing was found to be having adverse effects, then the area would have been narrowed down and its effects would have been further studied.

### 1.7 Limitations of centralization

To put together locality and time specific information on the required extensive scale, it is essential to organize a decentralized effort with participation of the people. In this context enough technically trained people are simply not available. Take an example of 'Botanical Survey of India ( B.S.I.). It is the responsibility of this organization to produce floras for the entire country. However, it is estimated that it will take another century to complete this task. Meanwhile, due to unrestricted trade the abundance of medicinal plant species is declining. As a measure to curb this, Government of India, on the advice of the BSI, has compiled a list of medicinal plants and prohibited the export of drugs made using any of the herbs in this list. After the drug companies objected that the list was baseless, an inquiry was made as to what information was used in compiling the list. It was proved

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that the information used in the preparation of the list was very scanty and the government then lifted the ban.

The Planning Board of the Government of Karnataka conducted a study on the status of medicinal plants in Karnataka. In the state, 300 different plant species are used for commercial purposes, and several others for domestic purposes. Out of the 300 commercially used species the forest department has some information about only 27 species like Myrobolan, Amla, Shikekai not about actual quantities, but in the form of money received at auctions held in different areas. It is plants. The forest department or even the pharmaceutical companies had no information about the remaining 273 species.

### 1.8 Gathering Knowledge - a participatory process

Looking at this picture, the Indian Institute of Science, Bengaluru took up a small project in collaboration with 42 schools in Karnataka. Teachers and students of these schools were provided with an illustrated booklet giving information about the 300 commercially important species, their Kannada names and received 2 days of training. The teachers and students of these schools then assessed the extent of availability and use of these medicinal plants in their own localities with the help of local knowledgeable villagers. It

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was not possible to make numerical estimates over a four-month period.

However, a lot of information on whether the species is abundant, common, rare, whether their abundance has increased or decreased in the last few years, what are the reasons behind some changes and how to better manage the medicinal plants in the area was collected systematically. When the data from all the schools was compiled, it was found that out of the 300 species, at least some information was collected for 172 of them. In this way, it became clear that with the help of local teachers-students and knowledgeable people in the community, information about species familiar to and important to them could be collected very efficiently.

### 1.9 Practical Ecological Knowledge

People living close to nature possess a substantial understanding of the working of the natural world acquired over generations, and in the course of their day-to-day pursuit of livelihoods. The experience of a group of Bengaluru based ecologists investigating the fate of wild *amla* (*Phyllanthus emblica*) populations on the nearby B R T Hills provides an



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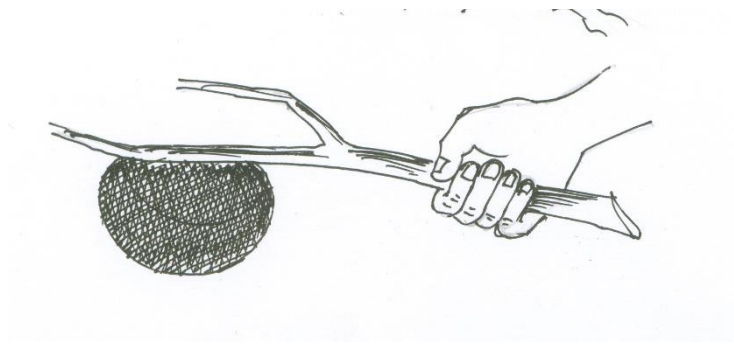
interesting case history. Their hypothesis was that the regeneration of *amla* is governed by the amount of fruit collected for commercial use, and that the low levels of regeneration in recent years were related to excessive harvests of fruit. So they laid out statistically well-designed experiments to test the influence of different levels of harvests of fruit. The local Soliga tribal people told them that these experiments would yield no results of interest, because, according to their understanding of the ecosystem based on many years of first hand observations, the levels of regeneration were primarily influenced by forest fires. *Amla* seeds require fire to germinate well, and the Soligas felt that low levels of regeneration were related to suppression of forest fires in recent years. The scientists did not initially give credence to this suggestion and continued their experiments. Only later did they come to the conclusion that the Soligas were indeed right.

Shepherds, sages, hunters and forest dwellers dependent on plant roots and tubers for food have living knowledge of medicinal plants.

- **Sushrut Sanhita**

In our country, 28% of the villages are in the vicinity of forests, many more are near rivers and seas, so that a large portion of our population is directly dependent on natural resources and is well-informed about them. This knowledge should be the basis of sound adaptive management of nature.

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These people have many good traditions of nature conservation. Banayan, Peepal, Gular and other trees fo genus *Ficus*, red cedar,

khejadi trees are scattered all over our country. They are considered sacred and hence are protected. Today, according to ecologists, all these tree species are considered to be the keystone resources. These species bear fruit when all other trees and shrubs have no fruit at all. During this period many insects, birds, monkeys, squirrels and bats survive by eating these fruits. Therefore, science teaches us that it is important to preserve them from the point of view of nature conservation. This has been a part of our traditional wisdom.

### 1.10 People deprived of their rights

But it is not at all the case that nature is being protected and maintained by the people today. All rights over the natural resources of the people were taken away ever since the times of British rule and these resources were drained first to build the British economy and then to support our industries and urban needs. In 1975, bamboo was made available to paper mills at a throw away rate of one and half to two rupees a ton, while

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the basket-weavers had to pay Rs. 1500 per ton. With such perverse incentives, people too lost their traditions of conserving natural resources and ended up destroying them. This system was changed in some places such as in Garhwal and Kumaon and in 1931 the government handed over some of the local forest resources to the people's forest panchayats. Earlier to this the Indian Forest Act of 1927 had provided for Village Forests, but had not been implemented. Even prior to the enactment of Village Forest in the Forest Act, three villages in Uttara Kannada district - Murur, Halkar and Chitragi - had been formally assigned the authority to protect their traditional village forests in 1924. This they had been doing very efficiently. But after the linguistic reorganization of states in 1956, this area became a part of Karnataka and immediately a decree was issued whereby the village forest system was abolished. Within a few weeks of the issuance of this decree, the villagers of Chitragi cleared their village forest. Halkar people rushed to the court and after 28 years, the court ruled in their favor. They have been protecting the forest effectively to this day.

### 2. Government efforts and laws

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### 2.1 Joint forest management

Fortunately the tide is turning. Joint Forest Management, Extension of Panchayat Raj to Scheduled Areas, Protection of Plant Variety and Farmers' Rights Act, Biological Diversity Act and the Scheduled Tribes and other Traditional Forest Dwellers (Rights over the Forest) Act have conferred substantial rights over natural resources to local communities. Along with the rights, of course, comes the duty, the responsibility of using this natural wealth prudently, in a sustainable fashion. At the same time the National Rural Employment Guarantee Scheme has opened up opportunities to earn a livelihood, while protecting nature, and rejuvenating natural resources. If we employ the provisions of all these various acts in an integrated fashion, it is surely possible to accomplish a great deal.

Be it known,  
regulations are for the humans,  
not humans for regulation,  
If regulations are hurdles in  
progress, disown them,  
Show your innovative mettle!

***Tutari - a poem by  
Keshavasut***

Recognizing that nurturing forest is not possible without the help of the people around, the forest department in 1980 sought the cooperation of the people and initiated a joint forest management plan in

the Arabari block in West Bengal. In 1990, the Central Government issued an order in this regard. Based on this order and using foreign aid, thousands of joint forest management committees were set up across the country. But people failed to be benefitted because the promise of distribution of dividend to local people in case of fellings in the forest under joint forest management has not been implemented almost anywhere.

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### 2.2 Tribal autonomy

#### Tribal Self-rule

Yet, we have been marching ahead, albeit haltingly, thanks to the growing strength of our democratic institutions. As a part of this process, the provisions of Panchayat Raj were extended to Scheduled V Areas in 1996. This conferred on local communities full rights over fuelwood, grazing and minor forest produce. Yet important MFP's like bamboo and tendu were immediately excluded from these rights. Within a year, the Government of Maharashtra declared that the Gram Panchayats were incompetent to handle MFPs and handed over monopoly rights to Tribal development Corporation. This was totally unjustified, and was done without any consultations with the Panchayat authorities. So people ended up gaining little out of PESA.

### 2.3 Biodiversity Act

This was followed by the passage of the Biodiversity Act in 2002. As mentioned in the overview the objectives of the act are conservation of biodiversity, its sustainable use and equitable sharing of benefits. The Act explicitly states that “ Every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and micro organisms and chronicling of knowledge relating to biological diversity.” The scope of

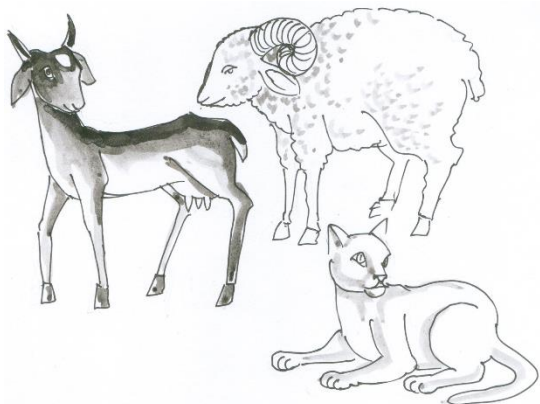
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biodiversity is thus not limited to plants. There are aquatic animals in the sea and river, there are crops grown in agriculture, horticulture, flowers, fruit trees. It includes domesticated livestock, and very importantly a variety of habitats in the nature. The Biodiversity Management Committees are explicitly empowered to manage this whole range of biodiversity along with their habitats.

An authority has been set up at the national level to enforce this law. At the state level, boards have been established in many states. But importantly, according to this Act, Biodiversity Management Committees will be formed in all local bodies, i.e Gram Panchayats, Taluka Panchayats, Zilla Parishads, Municipalities and Municipal Corporations. These local level committees have the right to manage the biodiversity in their area, to allow or deny outsiders the use of biodiversity in their area, and to collect collection fees if allowed. Apart from managing the biological resources, the purpose of this law is to manage knowledge related to biodiversity. Just as the local biodiversity committees can control the use of biological resources by the outsiders, so also they can control the registration and use of relevant knowledge by outsiders. These committees can levy collection charges for this. The National Biodiversity Authority can regulate patents and similar intellectual property rights. It is the duty of the Authority to approve the application of a patent for the use of any knowledge of the biological resource in India, and while doing so to arrange for a fair share of the profit

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with the Indian holders of that knowledge. The Biodiversity Act also stipulates that while doing this the next steps will be taken in consultation with all local biodiversity management committees.



Many Gram Panchayat level or their constituent village level committees like Joint Forest Management Committees, Watershed Management Committees have been set up so far.

These can be set up or dismissed at the whim of various government departments. On the other hand, Biodiversity Management Committees will be formed in all local bodies in accordance with this Act and their formation will not require permission or registration of any government department. These committees can open their own biodiversity fund. For this, they can open a bank account and make transactions. For these reasons, these committees are likely to be stronger and will be able to operate efficiently. There are some difficulties in this regard. The first is how to ensure that the knowledge of the people that is reported by these committees will not be misused. How to make sure that this record is kept confidential and will only be shown to those who agree to the terms of those who shared the knowledge ? The National Biodiversity Authority has not yet made clear rules in this regard. Another difficulty is to determine the area

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under its jurisdiction of the Biodiversity Management Committees. If the land under the jurisdiction of the forest department is not included, the people's jurisdiction will be limited to private and common land outside the forest and these committees will become meaningless, as far as the forest land is concerned, and in many places as in the case of PESA committees. But now another new law namely Forest Rights Act (2006) enacted by the Indian government has overcome the problem of forest land.

Yet as mentioned in the overview the Rules formulated in 2004 have taken away the role of BMCs in management, and force them to disclose their intellectual property. So there is still a long struggle ahead for the people.

### 2.4 Forest Rights Act

According to the “Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006” all the tribal communities and other forest dwellers who have been tilling the forest land for 75 years or more are given individual rights to cultivate it and to manage collectively the community forest resources and use them in sustainable manner. The law clarifies that community forest resources may include areas in reserved forests, sanctuaries or even national park. It is then clear that the jurisdiction of local biodiversity management committees will also cover these forest



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areas in the context of community forest resources. In this way, if both these laws and the provisions of the Tribal Self-rule Act are used properly, the forest dwellers of India can now be freed from the slavery of colonial rules and enjoy freedom for the first time.

### 2.5 Agricultural diversity Act



The Protection Of Plant Varieties And Farmers' Rights Act, 2001 provides for the establishment of an effective system for

protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants. Under this Act a farmer who has bred or developed a new variety shall be entitled for registration and other protection in like manner as a breeder of a variety under this Act.

**Farmer's rights:** A farmer who is engaged in the conservation of genetic resources of land races and wild relatives of economic

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plants and their improvement through selection and preservation shall be entitled in the prescribed manner for recognition and reward from the Gene Fund.

**Rights of communities:** Any person, group of persons (whether actively engaged in farming or not) or any governmental or non-governmental organisation may on behalf of any village or local community in India, file in any notified centre any claim attributable to the contribution of the people of that village or local community, as the case may be, in the evolution of any variety. The community shall be entitled in the prescribed manner for recognition and reward from the Gene Fund. The Local Biodiversity Management Committees formed according to the Biodiversity Act will play an important role in documentation of Farmer's and Community varieties as per this act.

### 2.6 People oriented planning

In 1986, the Central Government launched the Literacy Mission as one of the its Technology Missions. Kerala Sastra Sahitya Parishad, Kerala's popular science movement actively participated in this mission coordinating the efforts of the

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administration, voluntary groups, and social activists. This led to Ernakulam being declared as the first district to achieve total literacy in the country by 1990.

KSSP planned to take this success further by engaging the newly literate people in socially constructive activities. This led to the Panchayat Level Resource Mapping (PLRM) programme, which involved people in collecting data and mapping the local natural and man-made resources, which would help in planning future use of land and resources at the panchayat level. The 72nd and the 73rd Constitutional Amendments of 1991 provided for the establishment of Panchayati Raj institutions at the district, block, and panchayat levels. The panchayats were empowered with respect to: (i) preparation of plans for economic development and social justice; and (ii) implementation of schemes for economic development and social justice as may be entrusted to them, including those in relation to matters listed in the 11th Schedule of the Constitution. The Government of Kerala issued the necessary orders for these provisions to cover all the gram panchayats of the state in a span of five years from 1991, and the PLRM programme was implemented during 1991-3, with a pilot programme in the panchayat of Kalliasseri in Kannur district. Kalliasseri's experience of a 'Panchayath Vikasana Samithi' based on neighbourhood groups was a significant component of the Kerala's People's Planning Campaign of 1995-6. Through this initiative participatory development plans were prepared for every Panchayat in Kerala. But in reality, there is not much power at the local level beyond choosing from the schemes

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decided at the district level for implementation. And this experiment has also turned out to be a failure..

### 2.7 People's Biodiversity Registers of local Biodiversity Management

#### Committees

Ecosystems are complex natural systems variable in space and time. An understanding of this variation is best achieved by taking advantage of the practical ecological knowledge and historical experiences of local communities. Such knowledge can be effectively documented as People's Biodiversity Register that can serve as powerful tool for managing local biodiversity resources by every BMC. The work on preparation of such Registers started in 1995 when Bengaluru-based Foundation for Revitalization of Local Health Traditions initiated a program of community registration of medicinal plants. This was taken further by the Indian Institute of Science in Bengaluru in collaboration with a number of educational institutes and NGOs in seven states of the country. During 1995-97, they prepared such documents in 52 villages in Rajasthan, Himachal Pradesh, Assam, Orissa, Jharkhand, Karnataka and Andaman and Nicobar. After this, all the 82 Gram panchayats in the fully literate Ernakulam district of Kerala prepared such Registers focusing mainly on agriculture. Many organizations like Navdhanya, Deccan Development

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Society, Society for Environment and Development have also contributed to this effort.

As a follow-up, the Indian Institute of Science developed a detailed methodology and designed a relational database using a database management system. This was discussed in detail in 5 nationwide seminars in Bengaluru, Pune, Delhi, Bhubaneswar and Guwahati. Finally, in June 2006, it was discussed and approved by the National Biodiversity Authority in a national seminar. In this way a well-organized framework for planning at the basic village level has been made available.

The law stipulates that a People's Biodiversity Register should be prepared by the BMC at Gram Panchayat level for the entire jurisdiction of the Gram Panchayat. However, when we started working with some BMCs in Maharashtra for the preparation of PBRs it was observed that for those Gram Panchayat areas which cover more than one settlement or different hamlets like wadi/ pada/ guda/ tola the information may differ or at times is contradictory for certain issues. The documentation then needs reference of the specific hamlet for each component of information and the documentation becomes cumbersome. To overcome this problem, we suggest that PBR for each such hamlet may be prepared separately and finally all of them may be amalgamated into one PBR for the BMC. We found this as a suitable

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approach where the diverse perspectives of the people from different localities can be documented without ignoring none.

### 2.8 National Rural Employment Guarantee Scheme

A National Rural Employment Guarantee Scheme (NREGS) has been instituted since 2006 by the Government of India on the pattern of Maharashtra's 55 year old Employment Guarantee Scheme. The long term objective of this programme is to augment the natural resource base to generate self-employment. At the same time it aims to ameliorate rural poverty by providing immediate employment, or in its absence, unemployment allowance. The Ministry of Rural Development, Government of India, has come out with a "Brief Description of Permissible Works under MGNREGS" on 5<sup>th</sup> June 2017. This list prescribes 100 works under Natural Resource Management out of which 71 are water related and 17 are plantation related. The Act attempts to ensure transparency and people's participation in the entire process. In particular, it is the Gram Sabha that is expected to assess the employment needs of the various families in different seasons and on that basis plan the entire basket of work to be undertaken from the prescribed list. Soil and water conservation and afforestation works are to be undertaken on a priority basis under NREGS. These may also be carried out on private lands of tribal and other economically disadvantaged families. The Gram Sabha is expected to prepare such a plan each year by December, and this plan has to be accepted so long as it conforms to the overall plan of works to be

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undertaken under the scheme. A minimum of half of these works are to be executed by the Gram Panchayat; and private contractors can have no role in this scheme.

Despite these assertions in the law and in the guidelines, it will still take a lot of efforts to put them into practice. One of the problems is that planning of such works is a new thing for the Gram Sabha. Presently, the procedure is being followed as per provisions of the rules on paper, but on discussion with the villagers it seems that decisions are not informed ones. For that, we have to build their capacity. It will definitely be of great use to provide them with guidelines to do this.

The National Rural Employment Guarantee Scheme also emphasizes the use of computers. The idea is to computerize all information at all levels and make it publicly available on the web. Much progress has been made in this direction and the website <https://nrega.nic.in> is very much in place. Today computers and smartphones have reached even the rural areas. The youths in the rural area adept in using the smartphones can see all reports regarding the works.

As per the provision of the Act, every family who wants to work in NERGA can register and a jobcard is issued in the name of head of the family. The jobcard lists names of all the adults in the family. Therefore, it is definitely worthwhile to take advantage of the computerization of the National Employment Guarantee Scheme up to the village level. In this context, the

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methodology that has been developed for the planning of biodiversity at the village level, and the database that can be created, can be of great use.

### 2.9 Summary

To summarize what has been said is :

#### (1) The Protection of Plant Varieties And Farmers' Rights Act, 2001

provides for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants. The two laws namely Tribal self-rule and The Forest Rights Act have now given the local people firm rights over forest resources. Along with these rights, they have the responsibility to use these natural resources wisely and sustainably. The people in villages which are not close to forest area as well as those from forested area require a detailed knowledge of the natural resources and planning for its sustainable use. This planning cannot be done and will not be proper to be done by any central authority. It needs to be flexible, adapting to the situation, taking into account the location-time-features. This work should be done continuously with the participation of people who are close to nature, i.e. through Gram Sabha. There is, therefore, strong need of capacity building of the Gram



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Sabha. As part of this capacity building, a framework for planning, information gathering and interpretation should be provided.

(2) National Employment Guarantee Program is a great opportunity to protect, nurture and augment natural resources. For this, the entire responsibility of planning the work has been entrusted to the Gram Sabha. It is the duty of the Gram Sabha to make a systematic plan for such work. This planning can be properly integrated with forest management planning.

(3) As per the Protection of Crop varieties and Farmers' Rights Act, all the traditional crops will be registered and the farmers who preserve those crop varieties will get special subsidy. The registration and preservation of such traditional crop variety and the varieties developed by the farmers themselves will be a part of the natural resource planning at the village level.

(4) As per the Biodiversity Act, an official mechanism has been set up at the Gram Panchayat level to collect and manage information on biodiversity and related knowledge. This system can be used to manage the natural resources at the village level. Combining this planning with the planning that should be done in accordance with other laws will make a solid, cohesive work possible.

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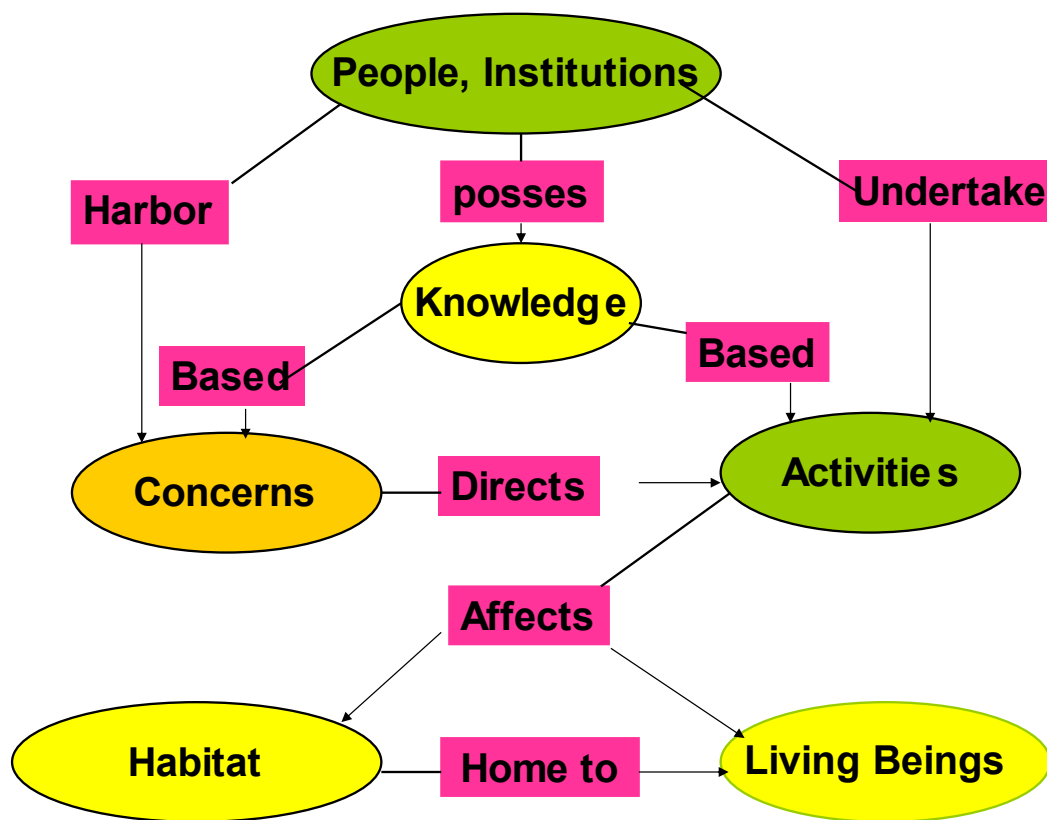
### 3 Broad nature of biodiversity document

#### 3.1 Holistic vision

The work of management and planning of natural resource must be grounded in a holistic, systems view. This is because it should aim not only to protect and conserve nature, but also to uplift the living standards of the people who are connected with nature but deprived of economic development. Moreover, conservation of nature does not mean the cultivation of monotonous teak or eucalyptus, but the protection and conservation of various species useful to the people such as amla, myrobolan, Beheda, soapnut, mango, jamun, berries etc., conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals, micro organisms etc. The basic information that needs to be gathered for this will have many facets - Landscape, waterscape, species, people, their institution, their knowledge, interests, activities and management practices. Moreover, all these subjects are interconnected ( see figure 1). Shepherds are closely related to sheep and grasslands. They will have knowledge about sheep diseases. Horticulturists will be curious about the subsidy they will get for maintaining the traditional varieties of mangoes. While arranging information, it is also important to show the interrelationships between the different components. Fortunately, the "databases" that can be created with the help of modern

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information technology, can be used to record the various components and their relationships between each other. This facility has been properly utilized in the preparation of People's Biodiversity Register ( PBR) by us while preparing exemplar PBRs at CES at IISc Bengaluru.



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Figure 1 : Showing relationships of various components of biodiversity responsibility of the Biodiversity Management Committees of the Gram

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### 3.2 Partnership with educational institutions

Who will compile such comprehensive information? As per the Biodiversity Act this is the responsibility of Biodiversity Management Committees of Panchayat-Municipalities.

This responsibility has been given to the Gram Sabha in the guidelines of the National Employment Guarantee Scheme and there is a provision to appoint a village employment attendant (Rojgar Sewak) to help in this matter. The Gram Sabha should also appoint where appropriate a Forest Rights Committee in accordance with the provisions of the Forest Rights Act for Tribal and Traditional Forest Dwellers. Thus this work should be done by the people themselves. This is perfectly appropriate. But this work needs literacy, practice of arithmetic, knowledge of reading and drawing map. It would be therefore appropriate for teachers and students whose main work is to acquire knowledge, to participate in the information gathering work and preparation of PBR. Environment is a compulsory subject in schools and colleges. In the context of this study, teachers and students can easily contribute to the work of PBR. R.T.M. Nagpur University has given official approval to the preparation of PBR as a college environment course. This work can also be taken up through the National Service Scheme.

Therefore, it would be timely and appropriate for the villagers-citizens, educational institutes, charitable organizations, and concerned government

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officials to take the initiative and contribute to this work wherever possible to the maximum possible extent.

### 3.3 Flexibility and standardization

Now the question is, what should be the framework of this work, how compulsory should it be? Local community members should have the freedom to make appropriate changes in the format of PBR suitable to their place and time. PBR should not be a boring, template-filling activity. There should be no compulsion to use only written or only computerized information, cassettes of folksongs or village seed banks should also be allowed to be part of the PBR initiative.

While this may be true, it is important to use some 'standard' for the first attempt. The Toyota Company is known for its constant innovation. They start any work by setting a "standard". But this standard is not permanent. It is 'the best possible' method according to the experience of that time. Use of old standard is continued till the process of finding a better way, its testing and acceptance is completed. By using such standard we can find where we face problems and where is the need of improvements. Through this method, one can take advantage of the experience and knowledge gained in

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preceding work. It is from this perspective that we suggest a standard framework here.

### 3.4 Study group

This standard program has many components. The first is the study group. This work can be done through some study group comprising students, NGO workers, enthusiastic youth from the local community along with experienced people with a good knowledge of different aspects of biodiversity can work with them. These could include farmers knowledgeable about crop varieties and various agricultural practices, river fisherfolk like Dhiwar-Bhoi knowledgeable about river-fish, basket-weavers knowledgeable about bamboo, forest produce collectors knowledgeable about mahua or tendu. They may be guided by knowledgeable science and computer teachers from a college or a school.

This information should be scrutinized at different levels. For this, local members of the study group, local people, experts in various disciplines including teachers in agricultural institutions, concerned government officials can help. Apart from this, scientific names should be added to the local names of the species. This requires expert help. However, with the advent of new ICT technique an app “Google Lens” is available which is very useful

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and fairly accurate in finding scientific names of the species by taking and uploading snapshots of different parts of the species. In this regard India Biodiversity Portal ( <https://indiabiodiversity.org/>) is also very useful.

### 3.5 Advantages of computer

There are several advantages of computerizing certain types of information. The main advantage is to create an integrated picture from the information gathered in the many separate bits. Let us take an example of the plan to be prepared by the Gram Sabha for the National Employment Guarantee Scheme. While planning this scheme, you will need several types of information: (1) The families in the village, their need for employment, in which days they want employment (2) The terrain in and around the village, its condition, what kind of activities would be needed for the development of resources in different parts of this land (3) The ecosystem of the village, its condition, which kind of terrain is suitable for different species. What kind of activities would be appropriate for the development of the ecosystem (4) When employment can be provided to which families using employment guarantee scheme, what kind of nature conservation work can be done on which land.

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Obviously, different components of this information are interconnected. For example, we will collect information about different landscapes and different species. When this information is collated, it will be known which species thrive in which landscape. Then, it will be possible to determine for which species availability is less in a particular landscape patch in spite of favorable conditions. It is also important to link the information collected for the village with other outside information. For example, to determine the method by which selected species can be cultivated on the land which is available around the village. This information may be with the Agricultural University or with institutions like BAIF, some of it will be in written form, some will be in computerized databases. By relating this information to the information of our village, we will be able to decide what activities should be done, the days for doing these timely activities and what type of manpower will be needed for the same.



### 3.6 Advantages of Computerization

Where should I find my space in a  
maze of complex pictures and figures,  
How can I find my links through all this  
mess,  
This moment, I can see only this deep  
blue sky, trees, path, sunshine,  
creepers, butterflies, clouds and a string  
of herons.

- **Shanta Shelke (Gondan)**

Traditionally, all information is

collected in column-row tables. Many of  
its components are included in different  
tables. For example, a village table will  
show the information on landscape types  
of different land patches. The second

table of the village will contain information on which plant species are found  
on different land patches. Another table from the University of Agriculture will  
provide information of different land-types with their properties suitable for  
different plant species. If the information in these three tables is related, then  
it can be seen which patch of land in the village does not have a specific  
plant species even though the soil properties are favorable. Then it can be  
planned to plant these species on this patch of land. Coordinating such  
information using traditional tables is a daunting task. But it can be done in a  
computerized database within no time.

Of course, if such relations are to be established easily, it is necessary  
to record the required information in a somewhat standardized manner. To do  
this, we need to define all the elements or entities we are going to use  
along with their attributes in the overall information set, and what  
"relationships" of those entities have amongst themselves. There could be

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hundreds of such elements and they could have thousands of interrelationships. There is no limit to this. But when you decide to use certain types of entities in your information set, the information about them is to be recorded systematically. Take for example, plant species. Your database will contain data on this entity. This entity will have different instances. For example, mango and orange are two specific species of plants or are two instances. Each of these will have some properties or attributes. For example, their names. Also, language will be another entity in the database. Marathi, Hindi and Gondi could be three instances of language. Plant species and languages will be related to each other through their names. For example, the specific plant species Mango is called Amba in Marathi and Merka in Gondi. The scientific name will be another attribute of plants. The scientific name of mango is *Mangifera indica*. As it is standardized all over the world, it is very useful for connecting different databases to each other. For example, the Central Food Technology Research Institute of Mysore has developed an excellent database on different methods of making mango pickles, syrups and Jam. Once you know the scientific name of mango, you can take advantage of this database.

Some validations are imposed in the database to collect standardized information. Take the village pincode for sample. It has six digits. If you use more or less numbers or digits for it, the computer will invalidate it. We may

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impose a condition for security reason so that the computer will not allow you to enter further information without giving name of at least one member of the study group. We can make a provision so that the database identifies certain types of terrain such as forest, bush, grassland, orchard, farm, settlement, etc. While filling in the information about different land-patches, one has to mention what type of terrain it is from amongst a standardized list.

Being a standard database different queries can be posed in Standard Query Language (SQL) and reply could be found in any format like graphs, tables, essays. For example, if the Gram Sabha plans to submit a scheme to National Employment Guarantee Scheme, then the required information can be compiled as per the required format provided all relevant information is already entered in the database. For other purposes, for example, if you want to use a database to record people's knowledge on medicinal plants under the Biodiversity Act, then a provision can be done to give access to this information to a selected few individuals only and for others it will be a confidential information and they will have no access to it. Photographs, audio-clips and video clips can also be included as part of this database. For example, photographs of job seekers can be taken by a digital camera and stored in the database, and job card applications can be easily created through the database.

### 4. Field Data Collection

#### 4.1 Study area, duration and group

Any work of data collection and analysis is a team work. The members of the group should be credited for the work, and at the same time they should take the responsibility that the information has been collected properly and there are no errors or omissions in it. For this, the information about the study area, the period during which the study was done, and the roles of individuals who did it should be recorded at the outset. More information should be added as new members join the team or as the duration of the study increases.

It may be assumed that the study area for the PBR is a settlement plus the area of the natural resources on which the people in the settlement depend. But there are many finer issues. This settlement area could be a wadi or village in a rural area. Generally, a Gram Panchayat is formed by combining several such settlements or villages. A Panchayat in Maharashtra has a population of 6,000 to 10,000. This area will be very large. Therefore, PBRs should be prepared for a gramsabha of a small village or wadi or pada or tola etc. as a unit and all these integrated to generate the Gram

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Panchayat level PBR as has been suggested earlier. In the special case of PESA or the Tribal Forest Rights Act, Gramsabhas, which are more cohesive are considered as fundamental entity. PBR should be prepared on this basis. In a city these basic unit could be considered as neighborhoods or wards.

The subject of PBR is the natural resources on which the people in the settlement-village-neighborhood depend. For forested area where CFR are granted, the area from which these natural resources are gathered is the Community Resource Area of these people. Apart from forests, farmlands water bodies like lakes, rivers, creeks and seas will also be important resources of the people and they should also be included in the study area of PBR.

A different consideration has to be given for Nomadic tribes such as shepherds. They will be using the resources of larger areas. In case of a stable settlement the subject of PBR would be the settlement and its vicinity, but for a PBR focused on nomadic communities, the subjects would be different such as their troop, their herd and all the areas they traverse and the region they use.

The PBR study area is not necessarily a cohesive place, for both, the stable settlement or nomadic troop. It may be made up of different patches. Also, it may have been under use by others. Of course, if some part of such

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an area is cohesive and only for the use of that settlement, then naturally more attention will be paid to it.

People in urban areas depend on resources from far flung areas. Water comes to them from dams far away from their place, electricity is supplied from even farther place. Some of the poor people in the city collect firewood themselves and even catch and eat fish from rivers and lakes. We have to think about their way of life also. But the majority of people rely on natural surroundings only for recreation. In such a scenario, it seems appropriate to limit the area of study of urban neighborhoods or wards.

PBRs should be updated from time to time as per the Biodiversity Act. The Gram Sabha should complete the work plan by December every year for the implementation of NREGS. PBR should be revised every year or in alternate years. The information in it changes according to the seasons and should be collected accordingly. This means that the work should continue throughout the year. In fact, this work can be done even in a ten days camp of National Service Scheme.

### 4.2 Study team



The team that will be involved in this work will include local students, teachers, workers from NGOs, other enthusiastic individuals and knowledgeable citizens. The names, addresses, gender, age, photo of all these should be in the database. It should also include details of the

contributions made by everyone. The work of PBR will be of seven types. (1) Gathering information from direct observation, e.g. students will be able to estimate the number of Mahua trees or the availability of firewood by visiting the forest. (2) Recording information through interviews of knowledgeable individuals, farmers, animal husbandry and poultry keepers (3) Provide information based on experience, for example expert fishermen will tell about the changes that have taken place in the availability of different species of fish in the river, or a traditional healer will tell you about the properties of different medicinal plants. . (4) Recording information on the basis of documents, e.g. a record of how many families in the village are below the poverty line, or how much money was paid for the right to collect Shikekai at a Forest Department auction. (5) Provide the scientific names of the species: Experts will provide the scientific names of the local species or using

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**Google Lens App.** India Biodiversity Portal may be used to doubly confirm the scientific names of species after the suggestion from Google Lens.

Each member of the PBR team will be involved in one or more types of activities, and the period during which they play this role will be noted. Apart from this, PBR has a number of tables on various topics. It will also be noted which member of the group contributed to which table.

### 4.3 Stages of study

Once the study team is formed then the work of PBR could start step by step. This work can be done in the next 9 stages.

(I) To Determine area and duration of study.

(II) To finalize map of the study area through public participation, to map different landscape and waterscape types and elements from ecological point of view, and from an administrative point of view what are the rights over different areas - private, community or governmental. To decide from which area more information should be collected which will be useful.

(III) To collect available maps and note the following : types of production from farm, general information about the village and its surroundings, availability of minor minerals, animal husbandry, fish and other aquatic species and other resources in the village, history of the village, how



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many different communities have been associated with the village since what time, relationship between the village culture and nature.

(IV) To note all the species, breeds of animals, crops and their varieties, as well as important biological resources, the important uses of each of them known to the people. To decide for which species and their varieties more information needs to be gathered.

(V) To Determine which issues are important to the people and which should be studied in more details. To determine which different communities are intimately related and have special interest in different issues. Also to determine which landscape-waterscape elements, rare, threatened and endangered species are important in view of those issues.

(VI) To identify user groups from amongst the local communities and visiting nomadic communities and their activities in relation to the natural resources in the study area. To note necessary details about those sections of the community which will be useful, for example about those families who may demand work under NREGS, the families who claim to be traditional forest dwellers, Scheduled Castes and Scheduled Tribes.

(VII) To make survey of important landscape- waterscape elements, to note different of uses of these elements, changes taking place in those parts - erosion / landslides, the proportion of important species and biological resources in them, is it maintained as it should be, whether it is increasing or

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decreasing, how these landscape and waterscape elements should be managed from the point of view of different user groups, what policies, rules, procedures would be appropriate and what programs should be undertaken if they are to be used wisely and from long term perspective.

(VIII) To note status of important natural as well as cultivated / domesticated species and biological resources and changes in them, their value addition and sale. How these species and resources should be managed from the perspective of different user groups. What programs should be implemented, what policies, rules, methods would be appropriate to protect them and use them wisely with foresight.

(IX) To record the instances of man-animal conflict, threats to human life, livestock and crops from wildlife. Perspectives of different user groups to mitigate the threats.

(X) To prepare with consensus a management plan based on the wishes and aspirations of different user groups. For the conservation and wise uses of landscape-waterscape-species-biological resources policies, rules, collection fees, their conservation activities and the employment required, their value addition, and sales programs will be included in the plan.

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### 4.4 People's Knowledge



People's knowledge relating to natural resource management has a very important place in the implementation of above plan. It will be recorded and used. There is no possibility of hijacking of this knowledge and loss of intellectual property rights in this case. This possibility exists in case of other type of knowledge, for example, the medicinal uses of plants. So far no proper strategy or plan is in place to protect this sensitive knowledge. For this reason, it is recommended that no such knowledge of members of the community be recorded in the present methodology, although 2004 rules improperly make this compulsory.

### 4.5 Maps

The work of PBR can be started by preparing map of the study area with people's participation. The boundaries of the study area is defined as the boundary within which villagers have their farmlands and people collect resources to meet their daily needs e.g. firewood or fish, and is thus flexible. For cities it can be defined as wards. But in rural areas, the official

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definition of such a panchayat boundary is unreasonable. For forested areas where CFR are granted as per Forest Rights Act, it is necessary to determine the limits of the community resource. These limits may include reserved forests, part of national parks. Also, a single study area may spread over more than one village. So to begin the preparation of a participatory map, you have to involve people to discuss all these aspects, deciding on the boundary, demarcating it by drawing simple lines, showing places with common names.

For marking the boundaries people may use of available maps like Patwari map, maps of Forest Department for the forested area, toposheets provided by Geological Survey of India by charging some fees, maps from Remote Sensing Agencies who makes the maps available for given village by charging fees and finally Google Imageries which one can obtain for free from Google Earth application. These maps may be used to mark the study area using following criteria:

- (1) '*Nistar*' rights area. [ *Nistar* rights : Right to collect material from the forest area for use by the tribals]
- (2) The area where shifting cultivation is being done at present or was done in the past .
- (3) Traditional cattle grazing area, *Gochar*, *Gairan*.

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(4) Areas from where firewood, leaf litter, tubers, fodder, legumes, fish, crabs, mussels are collected, water bodies used for animals and areas wherefrom collection of medicinal plants is done traditionally.

(5) Areas with sacred plants, animals, rocks, ponds, groves.

(6) Cemetery / crematorium area.

(7) Area of drinking water.

(8) Areas where Land Conservation-Water Conservation work was done previously.

(9) Previously protected forest areas.

(10) Area of joint forest management.

(11) Areas for which auctions for collection of minor forest produce are done or such authority is given to the co-operative societies of forest workers.

(12) Areas allotted to tree growers' co-operative societies.

These and other similar traditional usage should be shown on this map. Some of these uses are self-evident from the popular names of the places, e.g. *Chavdar* Lake, *Sarpanacha Dongar*. As the people will easily understand the map by using such popular place-names, it should be recorded diligently. Some place-names are known in more details to people in a particular community, e.g., fishermen know different parts of the river by these names. These should also be noted.

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If the boundary demarcation is done on the field using smartphone based open-source App like “GPS Logger”, kml or gpx files are generated. By uploading these files on Google Earth one can view the Google Imagery of the demarcated area.

### 4.6 Landscape - Waterscape

On such a map, the terms given to different landscape-waterscape elements from the point of view of ecology should also be mentioned. If necessary, put layers of separate transparent plastic sheets one over other to mark the different areas. Over the last thirty years, a branch of science - Landscape Ecology - has developed with the advent of satellite imagery. Any terrain is a patchwork of different types of land and water covers. For example, the forest of Gadchiroli district has patches of dense forest, shrubs, farmland, villages, roads, streams, ponds spread over the whole area, while in the Konkan coastal area one finds interspersed patches of sea, creeks, rocky shores, sandy beaches, mangroves, farms, paddy fields, coconuts,

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Casuarina groves, and mango orchards. In terms of landscape ecology,

With greenery on both of its banks,  
flows a blue-dark brook through isles,  
A settlement of four hutments there  
beyond the hillock,  
Green huddling patches of farms  
jostling ahead  
A winding chalky trek goes through the  
greenery helter-skelter to the deep  
black whirlpool,  
Gular tree sits with its legs in the pool  
shadowing the sweet water blackening  
the waves.

- A poem by Balkavi

rivers, ponds, seas, creeks are  
considered as different types of  
waterscape types and paddy fields,  
grassland, mango orchards, settlements  
etc. are considered as different types of  
landscape types. There may be several  
patches or elements of each of

landscape/waterscape types e.g. numerous patches of coconut- casuarina  
orchards may be scattered along with the patches of paddy, grassland, or  
rivers-streams-lakes. To take another example, in Bhandara district, which is  
covered by tanks, a study area will have 15-20 different elements of the tank  
type of waterscape type, or a city will have several elements of each of three  
landscape types, namely, - densely populated, sparsely populated, plains.

For convenience, it is advisable to consider the following types of  
landscapes and waterscapes.

### Landscape - Waterscape type (Standard List)

1) Grassland: Mainly grass covered area
2) Shrubland open: Shrubs with scattered shrubs

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3) Forest low density
4) Forest medium density
5) Forest dense
6) Agriculture: Land for seasonal crops
7) Orchard: Orchard (mango, orange) or plantation of teak, cashew, eucalyptus)
8) Rocky land: Open rocky terrain
9) Settlement of dense population
10) Settlement of sparse population
11) Stream, rivers
12) Canals
13) Natural pond
14) Man-made lakes, dams
15) Creeks
16) Swampy region
17) The sea
18) Groundwater
19) Rocky sea coast
20) Sandy beach
21) Swampy beach
22) Mangrove



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23) Market
24) Warehouses
25) Factories
26) Special reserves of biodiversity - eg zoos, parks
27) Animal Husbandry Land - e.g. Dairy, Poultry

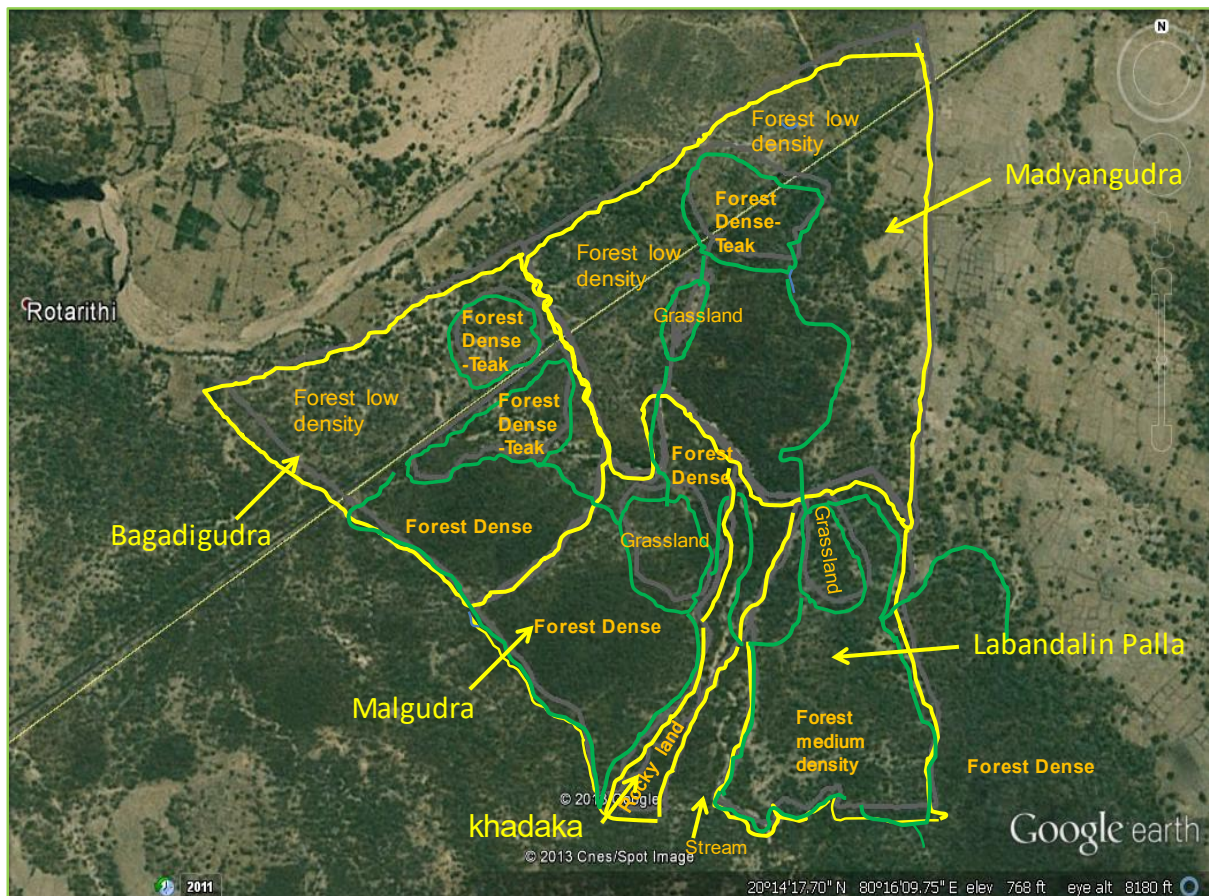


Figure 2 : Different LSEs (Boundaries in green) in 5 Tapus  
(Boundaries in yellow) of Pachgaon Community Forest Resource area

If these major LSE types are used everywhere, it will be easier to put together a holistic picture of the country. One may identify subtypes of these main types in any particular locality e.g. in low rainfall talukas like Baramati, two sub-types of agriculture are sugarcane plantation and sorghum-pigeon pea farms or sub-types of forest on the plateau of Sahyadri region could be evergreen and stunted evergreen forest. Each subtype should be assigned a unique number. For example, in Baramati taluka, sugarcane fields 6.1 and sorghum fields 6.2 can be used. If there are 5 different patches of sugarcane fields, they can be numbered as 6.1.1, 6.1.2, ... 6.1.5. Just as the survey numbers are used on the government land-record map, so these landscape ecological numbers will provide a systematic reference to different landscapes and waterscapes.

### 4.7 Layers of maps

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In addition to the map discussed above, more layers of the map can be created using maps showing the survey numbers of the forest department or the revenue department. According to the Forest Rights Act, various Forest Rights Management Committees will be set up at district, taluka / block and gramsabha levels. One of the duties of the taluka committees is to provide free maps of forest and revenue department to the gramsabha. So these maps should be available everywhere. In addition, latitude and longitude can be recorded using GPS devices wherever possible. Details like Private, Community, Government ownership can be displayed on this map.

In this way, using as many layers of maps as you want, observations and recordings will be done perfectly. People are enthusiastic about preparing maps through participatory process. In addition, maps need to be prepared to take full advantage of the Employment Guarantee Scheme, or Forest Rights Act . Therefore, people will also participate in this process with enthusiasm. Note of specific elements of landscape and waterscape should be taken where more attention is necessary in the context of say NREGS or pollution e.g. landslides triggered by quarries, wasteland, widening of river bed due to floods, places where industrial effluent is discharged in waterbody, landfills, farmland close to cement industries etc.

### 4.8 General Information

In the next phase of PBR, general information about the village should be collected. The information available with government departments need not be collected again. If necessary, all this information can be obtained using the Right to Information Act. But the information especially useful for maps must be obtained from the revenue-forest-water supply and other relevant government departments.

Information with the local people relevant to PBR on the use of natural resources, nomadic communities in the village and from outside, relation of these communities with nature, history of these communities and nature should be recorded. Particularly important subjects are water, agriculture, land, forest, animal husbandry, fisheries, major and minor minerals. Along with this, the history of communities is also significant. The Forest Rights Act has given rights to the Scheduled Tribes as well as other communities which have been dependent on the forest for three generations, i.e. 75 years. Those people who deserve it must get these rights but it is harmful if those who don't deserve get these rights. From this point of view, the history of all communities for the last 75-100 years should be recorded properly. The movements of these communities, deserting old settlements, forming new settlement, the means of their livelihood should be recorded.

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The culture of many communities in India is closely related to nature. Dance, songs, paintings, sayings, phrases, riddles are inspired by nature. People have a right on all these creations, as is mentioned in the Forest Rights Act. On bringing them on record, there is less likelihood of them being hijacked. On the contrary, others are freely using the paintings of the Varali community. If properly recorded possibility of establishing intellectual property rights over it will increase. Hence, this should also be recorded in the PBR.

### 4.9 Lifescape

One of the main objectives of PBR is to collect systematic information

Tree is of soil : I come from tree : I will again return to soil, - Shanta Shelke, Gondan

about biodiversity and bioresources.

But the diversity of life is tremendous.

According to our tradition a soul has to traverse through 84,00,000 births, 9 lakhs of aquatic organisms, 20 lakhs of plant types, 11 lakhs of insect types, 10 lakhs of bird

#### Total Animal Species in India

Animalia	99,701
Protista + Animalia	1,03, 258.
insects	66,363
birds	1346
mammals	432

types, 30 lakhs of beast types and 4 lakhs of human forms before reaching

#### Total Plant Species and microbes found in India

Angiosperms	21984
Gymnosperms	82
Pteridophytes	1314
Bryophytes	2800
Lichens	2989
Fungi	15602
Algae	9008
Microbes	1269

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Bramha. Today, according to scientific estimates, the total number of different species is around 80 lakhs to 120 lakhs. Of course, its modern division is a quite different. There are only 9,000 birds and 60-70 lakh insects. But the similarity between the total number as per modern science and our tradition is significant.

Scientists have described only 1.8 million species out of an estimated 10 million species in the world. Around 1,5 lakh of the described species are

### Living Forms – An experience of Chavani

A place called Chavani in taluka Khalapur of district Raigarh K(Maharashtra) inhabited by local tribes Katkari, Thakar and Dhangar is famous for a historical battle in the times of King Shivaji. Out of them the Katkari tribesmen are expert in fishing and bird hunting. All the three tribes together know names of minimum 443 species. Out of them the largest number 262 is of wild and cultivated plant species. Next comes 92 types of birds, 23 types of mammals, 13 types of snakes, 5 types of lizards, 6 types of amphibians, 11 types of fish, 5 types of crabs and 26 types of Arthropods ( insects, spiders etc.) They all have names. Besides they must be knowing local species like prawns, snails, turtles. In all, these people might be knowing nearly 500 different species.

( Rural Communes, Mumbai and Kalpavruksh, Pune prepared PBR of Chavani during 2000 to 2005. )

found in India. In the area of a panchayat, there could be about five per cent of it, that is, seven-eight thousand and may be another twenty-thirty thousand not yet described by science.. It is not possible to study such a great variety through PBR. Given the limitations of the PBR process, it would be reasonable to focus on species that are known and related to focal issues of the people. From the experience of the last ten years of PBR process it is observed that people know minimum 150-200 to 700-800 wild species, forty-

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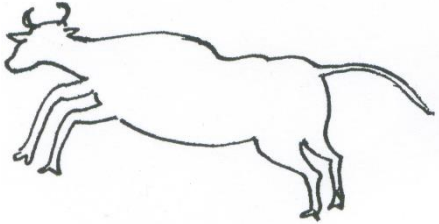
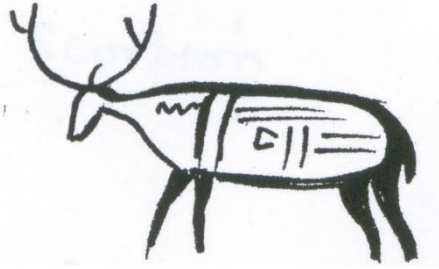
fifty cultivated plants and domesticated animals in one study area. So the next step is to make a list of these species. The list should include the attributes of the species like local names, the language in which they are named, and the importance of these species - and whether useful or harmful. In the next study, it should be decided for which of these species more detailed information - general or quantitative - should be collected.

In addition to the list of species, make a list of important biological resources. The list may include firewood, fodder, bamboo, cane, as well as litter useful as manure. In addition, harmful biological resources, e.g. weeds and birds that damage crops also need to be considered. The names of species included in these resources - as far as possible - should be recorded. For example, people may know the names of all the plants that are useful in bamboo-craft. But the names of all the species of grasses and shrubs used as fodder may not be known. According to the Forest Rights Act, each Gramsabha has to provide a list of minor forest produce and aquatic animals as per its own tradition. This work will be useful for that.

### 4.10 Scientific names



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Wherever possible, scientific names should be mentioned along with the local names of species. Since, scientific names are accepted worldwide information gathered in India or anywhere in the world can be used once the scientific name is understood. Many Indian plant products are also patented abroad, e.g. Turmeric ointment. One of the important objectives of the International Biodiversity Convention and the Indian Biodiversity Act is to ensure that if Indian species is utilized in this way commercially then we receive a share of the profit from it and that it should pass on to the knowledgeable people at the grassroots level. From this view, the first step would be to record the scientific names of the species mentioned in the PBR.



Classification of living beings.

At its base, the trunk of the tree of life is the same. The huge branches from the trunk of this tree are kingdoms like animals, plants, fungi . The next large branches are the phyla like arthropoda or the vertebrata. Branches of vertebrate phylum are classes like fish, reptile. Branches of reptile class are orders like snakes, turtles. The next step in the division of snake order is the family e.g uropeltids or shieldtails family. Further bifurcations into small branches and twigs and then the leaves attached to them are a species of snakes like cobra, Krait, Russell's viper or Ratsnake.

The definition of species is that males and females of the same species can only produce fertile progeny. Males and females of different species do not produce offspring, and even if they do, the offspring is infertile like mule. A species can have different varieties or breeds.

These different sized branches are different levels of classification. Here we take mango and cow as examples to demonstrate classification.

**Mango**

Domain : Eukaryote: All animals, plants, mushroom

Kingdom: Plantae: Algae, mosses, ferns, cycads, conifers and flowering plants

Phylum: Tracheophytes: All flowering plants e.g. grasses, orchids, coconut, banyan tree

Class : Magnoliopsida : e.g. all dicots, pigeon pea, jackfruit

Order : Sapindales

Family: Anacardiaceae e.g. Cashew, mango

Genus : Mangifera e.g Mango and its cousins like Mangifera sylvatica

Species : Mangifera indica : mango

Variety : e.g. Alphonso, Langada, Payari, Dasher

**Cow**

Domain : Eukaryote: All animals, plants, mushroom

Kingdom : Animalia: e.g. earthworm, snails, insects, fish, birds

Phylum: Chordata : e.g. fish, turtle, bird, elephant

Class : Mammalia : e.g. rat, dog, bat, monkeys

Order : Artiodactyla : e.g. deer, Antelope , sheep, buffalo

Family : Bovidae : e.g. buffalo

Genus : Bos : e.g. Gaur

Species : Bos taurus : cow-bull

Breed : Khillari, Gir

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### 4.11 Focal issues

It is the duty of all Indian citizens (emphasized in contexts like the Forest Rights Act) to ensure that local biodiversity is utilized in a sustainable manner. In order to fulfill this responsibility, different species should be used without causing much harm to them. Information about this sustainable harvesting available elsewhere needs to reach the local people. Scientific names must be the basis for this information. Therefore, efforts should be done to assign scientific names to the species **with the help of** google photo and lens Apps. For this, good photographs should be included in the PBR database using the digital cameras that are now readily available with smartphones. These pictures will be a good basis for authentication of proper identification of the species.

Oh! forest dwelling friend of mine,  
Which is your village?  
What are your occupations?  
What is your name?  
What are your customs?  
What is your language?  
How are the land, sky and water  
In your land?

- **Shanta Shelke (Gondan)**  
( With some change)

The PBR process is not meant only for the forest landscape or in the context of the Scheduled Tribes. Many traditional varieties of cultivated plants are found in the region of Konkan where mango orchards, Coconut-beetle nut-

Pepper orchards , Garcinia-Jack fruit flourish. The PBR process will be useful for their registration, protection from long term perspective and giving

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incentives and grants to the farmers who protect them. Coastal fishing villages also have problems with the conservation of the areas and local species. To overcome this, study with PBR methodology is also required. So the focus of PBR will not be the same in different study area, but will vary depending on the characteristics of each area. It is proper that the locals should decide the focus according to their needs. The next step in the PBR process, is to discuss and record key issues or focal issues of the local people. Take for example the village of Teligram in the Hooghly district of West Bengal. Telegram is situated in the fertile plains of the Ganges. There are small ponds and paddy fields, fish and ducks in the ponds. Pesticides are widely used in paddy cultivation. As a result, ducks' health deteriorates and fish production decreases. When the PBR work started in the village, the village sarpanch Mukta Rai suggested that the focus of the work should be on paddy pests, diseases and the methods used to control them. The purpose of PBR work should be to show how to reduce the use of chemicals using biological control and other means. In other words, rice, ducks, fish, their diseases in the context of species, paddy fields, ponds in the context of landscape and waterscape and farmers, duck breeders, fish farmers in the context of user groups will be the main topics of study.

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### 4.12 User groups

The important assumption behind the PBR process is that people are an integral part of the environment. Hence, an important part of the PBR is recording how different sections of community relate to natural resources. For this, it would be useful to categorize human society and human institutions according to their interest in biodiversity. In this context we can do classification as follows.

#### 1. Land owning farmers

##### 1.1 shifting cultivation

##### 1.2 Dryland farming

##### 1.3 Irrigated Farming

##### 1.4 Horticulture

##### 1.5 Tea, Coffee, Cardamom etc. plantation owner

##### 1.6 Owner of agricultural land used in production of timber like Casuarina

#### 2 collector

##### 2.1 Firewood collection

##### 2.2 Minor forest produce collection

##### 2.3 Collection of medicinal plants

#### 3 Fishing

##### 3.1 Freshwater fishing

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### 3.2 Collecting oysters

### 3.3 Shallow water fishing

### 3.4 Deep water fishing

### 3.5 Fishing in the sea

### 3.6 Oysters -picking

### 3.7 fishing using oar or by sail

### 3.8 Fishing by motor boat

### 3.9 Labor on fishing boats

## 4 Animal Husbandry / Fisheries

### 4.1 Local animal husbandry in one place

### 4.2 Pastoral nomads moving as per the seasons

### 4.3 Commercial Animal Husbandry: Poultry, Dairy Business

### 4.4 Low cost fishery in ponds

### 4.5 Commercial fish and shrimp fishery in ponds

## 5 Agricultural labor

### 5.1 Agricultural laborers in dryland agriculture

### 5.2 Agricultural laborers in irrigated farming

### 5.3 Agricultural laborers in horticulture

### 5.4 Tea, coffee plantation laborers

## 6 Laborers in fisheries / animal husbandry

### 6.1 Laborers in stable animal husbandry

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### 6.2 Laborers in nomadic animal husbandry

### 6.3 Laborers in fisheries

## 7 Processing of biological resources

### 7.1 Handicrafts, e.g. Bamboo work, Toddy removal

### 7.2 Cottage industries: e.g. Making bowls of palm leaves

### 7.3 Industries: Ayurvedic medicine factories

## 8 laborers in biological resource processing

### 8.1 laborers in cottage industries: e.g. Turning bidis at home

### 8.2 laborers in factories: e.g. Wage earner in a fruit juice factory

## 9 Trade in biological resources

### 9.1 Small scale: Selling vegetables on handcart

### 9.2 Large scale: Tendu leaves contractors

## 10 Laborer / jobs in the trade of biological resources

### 10.1 Small scale: laborer in vegetable shops

### 10.2 Large scale: Jobs in agro-based industries

## 11. Services based on biological resources

### 11.1 On a small scale: Traditional healers, Serpent charmer, priest of sacred grove

### 11.2 Large scale: Ecotourism Company

## 12. laborer / jobs in biological resource based services

### 12.1 On a small scale: Traditional healers' assistant

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### 12.2 Large scale: Ecotourism Guide

## 13. Management of biological resources

### 13.1 Forest manager: e.g. Forester

### 13.2 Extension services: e.g. Gramsevak

## 14. Work in an unorganized field not related to biological resources

### 14.1 Those interested in conservation of biological resources, e.g.

Bishnoi protecting deer

### 14.2 Others

## 15. Working in an organized field not related to biological resources

### 15.1 Those interested in conservation of biological resources, e.g.

Citizens active in the movement to save the hills in Pune

### 15.2 Others

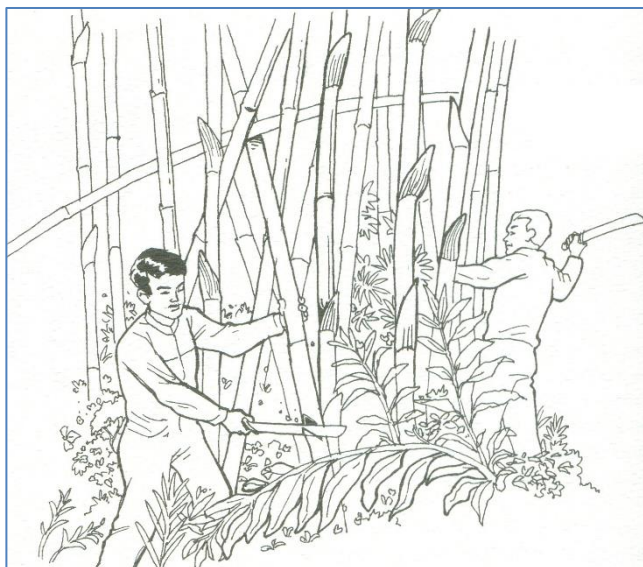
## 16. Businesses that adversely affect biological resources

### 16.1 In government sector: e.g. Government Mining Business

### 16.2 In the private sector: e.g. Chemical businesses that do not control

pollution

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### Classification of main user

groups in the local and regularly visiting nomadic communities using this framework - as far as possible- is a part of the PBR. It is not necessary to collect detailed information of each family in this regard. If the community is broadly

divided into 10-20 user groups, then the picture of the community as a whole will emerge. In small homogeneous village even fewer groups will be seen.

For example, in the village of Mendha-Lekha in Gadchiroli district, almost all the people subsist on rain-fed agriculture and forest. They will form a group.

There are very few landless people, who are mainly dependent on forest produce collection, they will form the second group, and a handful of

teachers and other employed people form a third group. A single family may

pursue multiple activities for subsistence. For example, people from Halakki

Vakkal community in Lukkeri village in Uttara Kannada district cultivate paddy,

cultivate Finger millet on hilly terrain, collect mussels in the creek, weave

Pandrus mats, do labor on farms, bring firewood from the forest and sell it

in the city. It is not our intention to place them in different categories in the

above classification. Broadly speaking, paddy farming seems to be the most



### User Groups in Amaziriya :

Amaziriya is a village in Sivani district in Madhyapradesh just 8 km away from the district place. Following User Groups were found in this village –  
1.3 Land owning farmers- Dryland Farming : Mainly cultivates land, collect minor forest produce and sale it, at times work as labour.

**8.1 Processing of biological resources – Handicrafts, Bansod :**  
This word comes from Bamboo in Hindi/Marathi. These people weave mats, baskets and curtains from bamboo.

11 Laborer in the trade of biological resources- Small scale : Snake charmers – A tribe involved in catching snakes and displaying them. They catch snakes from houses in cities and from wild. They collect and sell medicinal plants from Amarkantak, a place where Narmada river originates. Nowadays work as labourer.

Gonds depend on different types of crops, different types of forest flora and fauna, and depend mainly on agriculture and forest. Bansods are mainly dependent on bamboo and depend on a Landscape called forest. Snake charmers depend on different types of snake species and depend on landscape elements like farms, village and forest. Pardhis who hunt in the area of this village, school teachers, vendors and external labourers etc, are outsiders who depend on the village. These people are external users for Amaziriya.

( Zilla Parishad Middle School, Sivani prepared the PBR of this place during 2004 to 2007)

important means of their livelihood.

Therefore, for your classification, it would be appropriate to name them as paddy cultivators. But to draw a clear picture of the people's life, a list of other important activities of each group will be given, the rest of the means of subsistence will be mentioned in this list.

It is possible that such user groups are closely related to the castes and tribes of the community. But our purpose is to note people's relationship with nature. In some other contexts e.g. employment guarantee scheme, castes and tribes can also be recorded, but it is not the main purpose here. Here we want to record the major classes related to nature, all their important activities and their approximate number. This information will also be useful in the context of the Forest Rights Act. This

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information will help in determining which communities other than the Scheduled Tribes have been dependent on forest resources for the last three generations.

### 4.13 User Institutions

Like human beings, many human organizations are related to natural resources. Their details also need to be recorded. Examples - Organizations involved - city water supply and sewerage boards: discharge of city sewage into river may affect aquatic life, disease causing microorganisms affecting health of people and livestock downstream; Mining companies: filling ponds with mining debris, Paper mills: depleting bamboo population. The impact due to many of these organizations may be through different agents e.g. the paper mills may be awarding contracts to supply bamboo to contractor and the contractor may be bringing in laborers from outlying districts for bamboo cutting. If so, the mill will be a motivator, the contractor a mediator and people engaged in cutting will be laborer. It will be useful for you to record all these steps and their consequences- good or bad. **This information will be the basis for planning when the local gramsabha / ward prepare their Environmental Status Report - Microcatchment development plan etc.**

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### 4.14 Nomadic tribes

It is also important to record information about the nomadic tribes who regularly visit the village. The Forest Rights Act also gives **nomadic pastoral tribes not others like Phaseparadhi or Vaidu** the right to use their traditional resources as per the season. We have to record all the information about exactly when and what resources these people use, where they camp and what is their hometown.

PBR of a nomadic tribe: An experience of *Paradhi* Tanda

The *Phase Paradhi* is a traditional hunter nomadic tribe. The village of *Paradhi Tanda* of **xxxx village** has mapped out the biodiversity of the 30 kmx 30 km area that they use. While preparing the village document, people recorded information about the entire area. It includes different landscapes, their types, the vegetation, the extent of presence of animals that are hunted by the *Paradhis*, the user groups those depend on them, the distance of such landscape element from *Paradhi Tanda*, the condition of wildlife in this landscape element fifteen years ago, its present condition and its future. The villagers' views on all these aspects were recorded. Also, it was thought that PBR of other village on the area of which the people of *Paradhi* community depend for its biodiversity should be prepared so that it will have records of their activities. Hence PBR for one such village was prepared wherein the villagers noted the *Paradhi* community as an external users group and recorded the impact of the use of biodiversity by the *Paradhi* community. In this way, a system is set up wherein the information of the nomadic group like *Paradhi* community is recorded in their own village and also in other villages on whose area they depend for their biodiversity. Questions of the *Paradhi* community related to the biodiversity, their nature, their causality and measures to solve problems from the group's point of view were recorded. Considering the traditional nomadic nature of the group a system was thus put in place wherein their information could be recorded. However, in order to establish the rights of such groups, there is a need that they are represented in the Biodiversity Management Committees. Efforts and studies to achieve this are needed.

( Samvedana and Indian Institute of Science, Bangalore prepared the above PBRs during 2003 to 2004)

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### 4.15 Employment Guarantee

In addition to this general information, more detailed information about some families and individuals is required in the context of NREGS. Those persons of the families who want employment under the NREGS, their information should be noted and should be made a part of PBR database. Jobcard is a key document that entitles the household under NREGS and is issued in the name of the head of the household. Following information should be collected for the household

1. Name of the head of the household
2. Jobcard number.
3. Age of the head of the household
4. Aadhar Card Number
5. If belongs to Scheduled Caste/ Tribe/ Other
6. If Land received in Land Reforms programs
7. Whether beneficiaries of Indira Awas Yojana,
8. Aadhar-linked-bank account number and bank name and code
9. address
10. Photograph

Names of all other adult members should be recorded as below as they are included in the Jobcard of the household :

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- (1) Name of member of the family
- (2) Father's / Husband's Name
- (3) Age.
- (4) Aadhar Card Number
- (5) Aadhar linked bank account number and bank name and code
- (6) photograph.

The wages are transferred to the individual member's Aadhar-linked-bank account number. Photograph of the persons should also be included in PBR database.

### 4.16 Field Observations



The next stage of PBR is a physical observations on the field. At the time of creation of the participatory map, important landscape and waterscape elements must have been selected for further study. All the different elements that

have important natural resources which need to be managed carefully or those elements which are in poor state but want to be carefully revived

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should have been selected. Since it is not possible to study all the elements in details, some representative elements of each of the landscape-waterscape types should be selected for the study. The following information can be obtained from the study of all these:

1) What kind of benefits are obtained from specific landscape or waterscape element? This benefit may be in the form of material (e.g. bamboo, honey) or in the form of services (e.g. maintaining watershed in good condition). The extent of benefit, how it is changing over time? And the reasons behind the changes.

2) What is the harm caused by these elements? This damage can be in the form of materials (e.g. sewage) or in the form of problems (e.g. sheltering wild pigs which destroy crops). The extent of the damage, the changes in it, and the reasons behind the changes should be noted.

3) The occurrence of beneficial species in such elements. Is that changing? Reasons behind the change.

4) The occurrence of harmful species in such elements. Is that changing? Reasons behind the change.

5) The proportion of indicator species in such elements, e.g. lichen indicate air pollution.

6) What kind of removal/ harvesting is done by human intervention in these elements (e.g. removal of timber, harvesting of field crops, sand

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mining) or addition (e.g. factory smoke, chemical fertilizer in farmland) or changes (e.g. leveling by bulldozer). What are the pros and cons of these processes?

7) What are the user groups or organizations related to such elements? What is their role in current affairs? Who benefits, who suffers?

8) Which interventions will increase the benefits (e.g. regulation of how much to harvest or new plantation), or reduce damage. Who will be gainer/loser from this?

### 4.17 (a) Quantitative Estimation in selected LSEs



To prepare a sound plan of management of useful resources such as bamboo or myrobolan or oysters or firewood one needs to make systematic quantitative estimates. Thus one needs to assess the quantity of firewood that should be collected each year so that the tree cover sustains, and if it exceeds, its condition will

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deteriorate. For answering these queries the quantitative estimates of the trees and shrubs should be known and also the rate of their growth. As a part of the PBR, it is possible and necessary, to determine the populations of species in specific landscape-waterscape elements. It is not easy to determine the growth rate and reproduction rate of a particular species. This information will be collected from other sources.

Determining the populations or numbers of species means determining the number of insects or birds or plants of that species found in a particular area. Unlike the census of 130 crore Indians, it is impossible to count all individuals of the concerned species. Instead, the total number should be estimated using a sample just as we test if the rice is cooked by testing a sample from the whole container. For this, samples are taken by going to certain points in that area. The key element behind this is that the sampling points should be representatives of the total area. Estimate based excessively on the points where the species is much higher or much lower in number than the average, the estimate will go wrong. So first of all, the sample points should be taken in a random way, without any bias. There are statistical methods for determining such random points. Similarly there are also statistical methods for determining how many sampling points should be taken for observation. But since this work needs to be done in rural areas, we are suggesting a simpler way to arrive at reasonably accurate estimates.



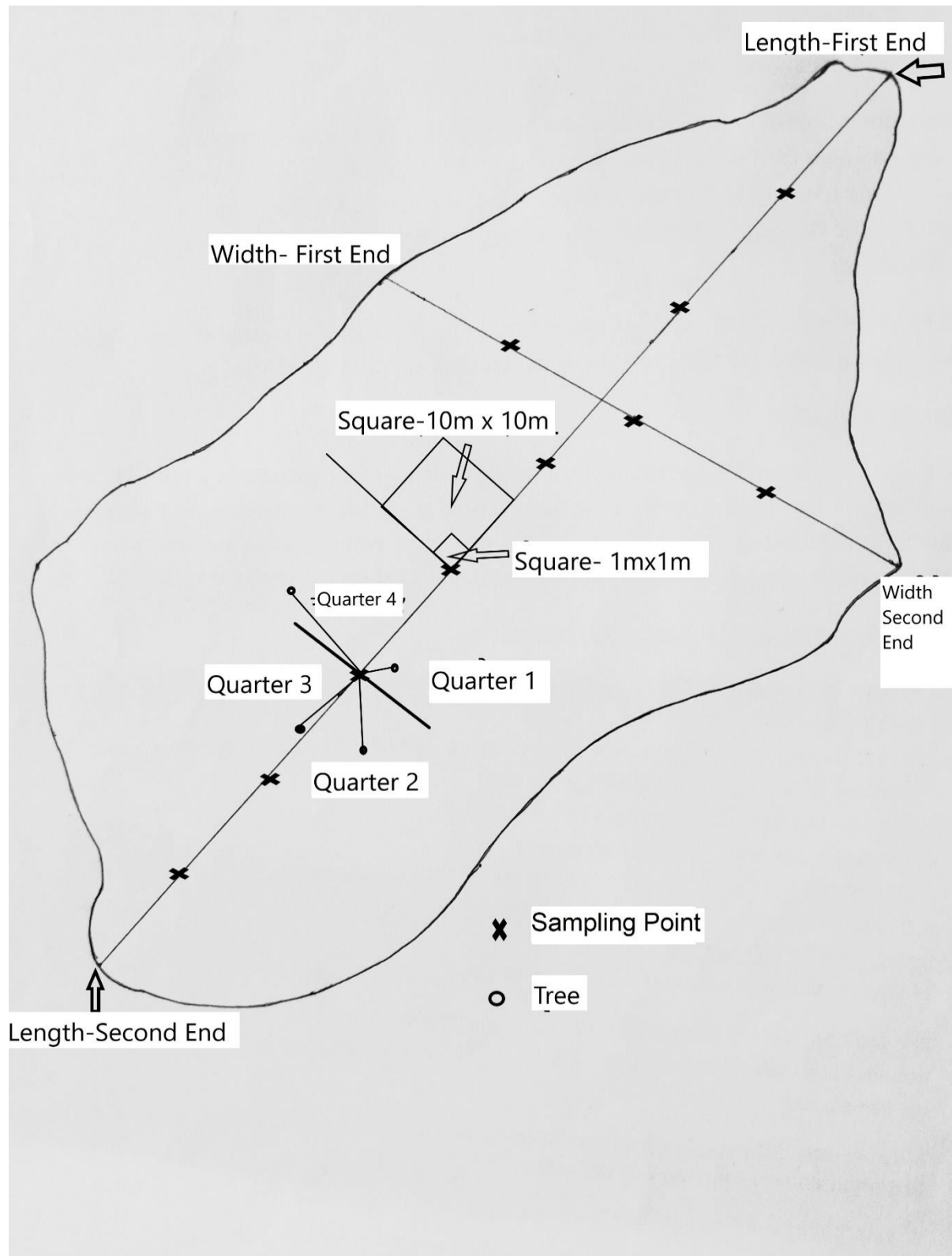
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Let us use " Point Centered Quarter Method" which is a simple but efficient method to determine per hector population of plant species on a given landscape element.

Let us first consider Landscape Elements. In general, such an element will have an irregular shape (see figure 3). On this landscape element, we will take 10 points by following a method which is not rigorous but is simple. In this method we find the two ends of this landscape patch such that distance between them is maximum. Let's call it the length of this patch. The width of this shape will be a line approximately at right angle to length. We draw it where the width is maximum. Now for taking observations let us take

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10 equidistant points on these two lines as follows :



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Figure 3: Sample points on a LSE and four quarters for each sampling point.

Let a person walk straight along the long line from one end to the other and count the number of steps. Also, count the number of steps from one end of the line of width to the other. E.g. Suppose walking along a line of length, the distance is 397 steps. Similarly for the width distance is 207 steps. Together on both these lines we have to take 10 points at equal distances (leaving the end points). For this we have to divide the total steps by 12. This means we divide  $(207 + 497 =) 604$  by 12. I.e.  $604 \div 12 \approx 50$ . Now start walking from one end of the length and after each 50 steps mark a point. We will get 7 points, leaving two end points. Also along the width 3 points will be obtained by leaving two end points.

Once the sampling point for observations are established there are different methods of making observations. Suppose we want to take observations for birds, then you have to stand at a sampling point for a given period say for one minute and watch the birds which are seen. This you may repeat for all the sampling points.

Study of tree density and their basal area : ( Table 14A) : For this we follow the same method as above (Point Centered Quarter Method). For this draw a second line at right angles to the main line at each sampling point.

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This gives us four quarters at each sampling point. Let us number these quarters clockwise as 1,2,3 and 4. Let us now make the following observations in the first quarter: Find the nearest tree in this quarter, note the species, its girth at the height of 1.3 m. above ground and its distance from the sampling point. A plant is considered as a tree If the girth is 13 cm or more at 1.3 meter above the ground level. (Ignore plants with girth below 13cm). This is repeated for all the four quarters for all the 10 sampling points making it a set of 40 observations. Using these readings we can determine number of different trees per hector and also their basal area per hector as follows:

Suppose there are a total of N observations.

Distances to the nearest tree in each square are recorded in meters.

Let us call D the distance to the nearest tree from the observation point.

First we average the distance D and call this average  $D_a$ .

$$D_a = (\sum D) / N.$$

Let K be the total number of trees per hectare.

$$\text{Therefore, } K = 10000/(D_a^2)$$

The value of K will be reduced if there are some vacant quarters, i.e. without trees. It has to be improved. Suppose the number of such vacant quarters is denoted by VacQrt.

New revised Number of trees per hectare  $K' = K \times (\text{correction factor})$ .

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$$\text{Correction factor} = 1 - [ \text{VacQtr} / \{4 \times N\} ]$$

After this let us calculate in how many quarters the tree species  $v$  is found. Let this number (  $N_v$  ).

$$\text{From this the number of trees } v \text{ per hectare, } K'_v = K' \times N_v/N$$

Now let us calculate the average basal area of each species. Suppose the average girth of a particular species  $v$  is  $C_v$  cm.

From this the average basal area (sq. m) of the of species  $v$ ,

$$A_v = C_v \times C_v / (40000 \times \pi). \quad (\pi = \text{Circumference/radius of a circle is a constant and its value is } 3.14. )$$

From this basal area of particular species per hectare (sq. m)

$$= K'_v \times A_v \text{ (sq. m)}$$

We can calculate all these numbers in EXCEL sheet.

Study of shrubs (Table 14B) : For this we draw a square of 10 m x 10 m in a given quarter say 4th quarter ( as shown in fig. 3) at each sampling point. We note : Number of shrubs for each shrub species, their heights and their canopy areas. From this we can make estimates as given below.

Study of herbs : For this we draw a square of 1m x 1m in a given quarter say 4th quarter ( as shown in fig. 3) at each sampling point. We note: Number of herb sapling for each species and their heights.

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The following indicators can be derived for shrub species and herb species:

(A)      Number of each shrub species per hectare =  $100 \times \frac{\text{total number in all squares}}{10000}$

Number of each herb species per hectare =  $10000 \times \frac{\text{total number in all squares}}{1000000}$

(B): Quartile Indices of Height for shrub/ herb species (Q1,Q2,Q3) - Height figures measured for each shrub species / herb species should be arranged in ascending order. From this the 3 height indices are determined as follows:

Q1 = height figure at 25% of total figures

Q2 = height figure at 50% of total figures

Q3 = height figure at 75% of total figures

(C) Quartile indices of Canopy for shrubs (Q1,Q2,Q3) - The canopy figures measured for each shrub species should be arranged in ascending order. From this the 3 indices of canopy are determined as follows:

Q1= canopy figure at 25% of all figures

Q2 = canopy figure at 50% of all figures

Q3 = canopy figure at 75% of all figures

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Just as we try to avoid bias in actual observation, the same efforts should be made while gathering information through communication with experienced persons. They should not be asked suggestive questions, their comments should be recorded accurately. As far as possible, different people should be interviewed at different times and all their statements should be verified. And then record what seems to be the most appropriate by consensus.

### 4.17 (B) Observations for WSE

We have to survey waterscape elements for recording the physical conditions of the waterbodies. For a tank, manmade or natural, we note its spread in different seasons, average depth etc. In case of river or rivulet we note its length in our study area, condition of bottom at different points, water flow, pollution etc. For this we need to take observations at some random sampling points. Like LSE here also we choose say 10 points along the bank so that the points are equidistant and without bias. In case of river we may choose additional points on the bank where due to sudden changes in the

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flow like a whirlpools or sharp turn in the course the flow becomes narrow and fast etc. This is shown in the figure 4 .

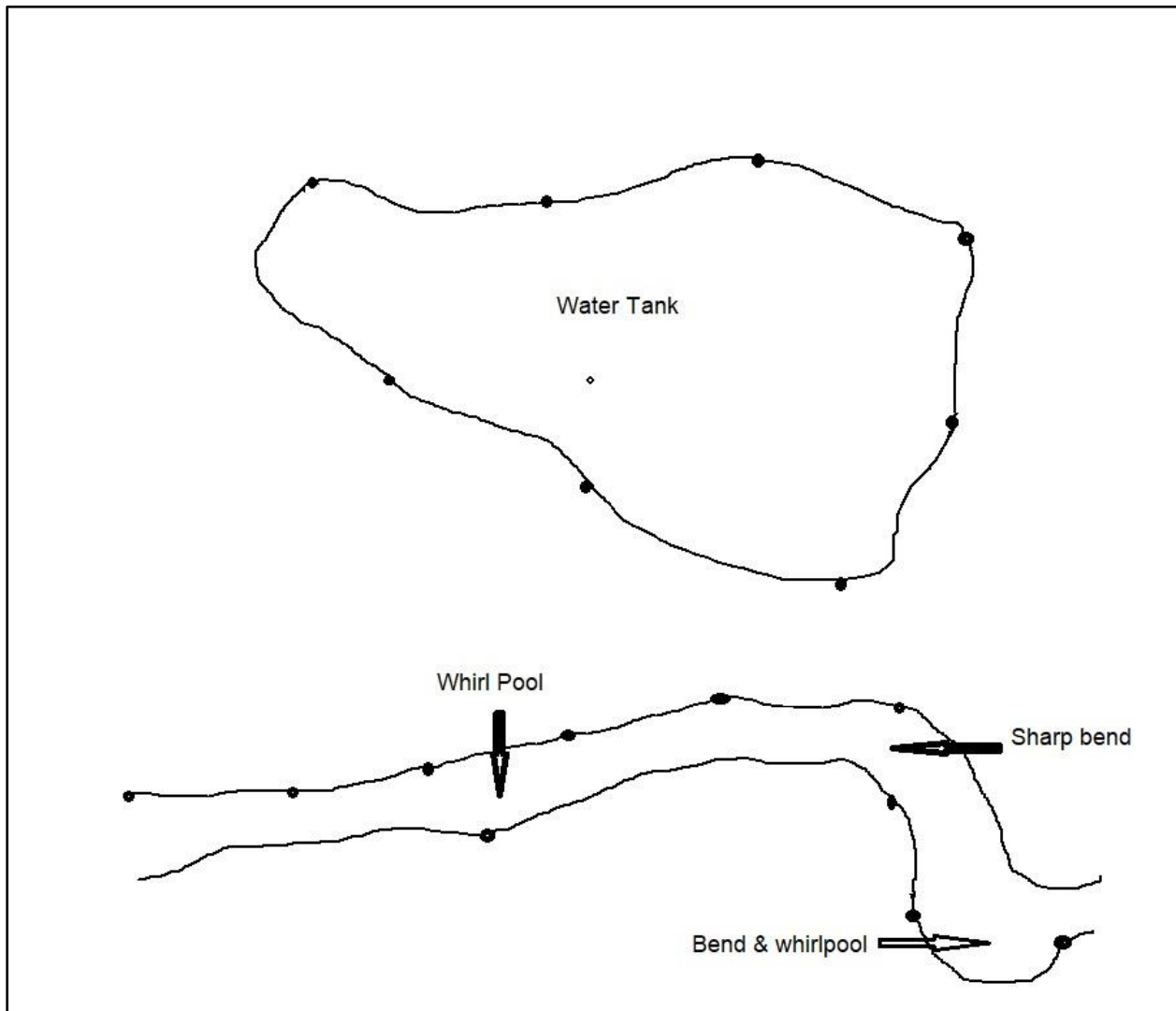


Figure 4 : Sampling points for waterbodies

### 4.18 Focus of study

Focus of study for different landscape-waterscape type will be different.



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(1) Grassland: Large tracts of traditionally available pasture land were allotted by the government for cultivation at the time of land reform or used for forest augmentation or construction works. Along with this, weeds like parthenium grew on such grazing lands. As a result there is shortage of fodder everywhere. The burden on the available grazing lands has increased. Nomadic herders like shepherds are getting into trouble. No systematic information about this situation is available anywhere. It will be therefore very useful if through PBR process a good understanding is developed on the available grassland area, fodder condition, how many cattle graze on it and how to manage the grazing lands.

2) Any of the following types of Landscape: Sparse- bushy- Rocky land, wasteland i.e the land with little cover where overburden has been removed, land with steep slopes and is untitled etc. There is a lot of such land all over India. The condition around human settlement is almost like this. Yet, people get many useful resources out of it. In case of CFR villages taking the responsibility along with the new rights over community resources, regulations for the proper utilization of these resources must be done and proper accounts of the resources should be maintained. For all types of settlements regulations should be done and the situation should be monitored to see if it is improving. It is hoped that this will happen through the PBR process.

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(3) Planning for Employment Generation: One of the important objectives of the National Rural Employment Guarantee Scheme (NREGS) is to revive green cover by improving the soil on common land and also private land. The following types of work can be done under this scheme.

(A) Water conservation, water storage and groundwater recharge :  
underground dykes, earthen dams, stop dams, check dams

(B) Drought mitigation, afforestation and tree plantation: tree plantation and horticulture in common and forest land, road margins, canal bunds, tank foreshores and costal belts

(C) Canals - new works, renovation and maintenance of irrigation canals and drains, micro and small dams for water supply

(D) Soil conservation and water supply on land owned by Scheduled Castes / Tribes who are the beneficiaries of Land Reforms Act and of Indira Awas Yojana

(F) Revival of traditional reservoirs, removal of silt from ponds

(G) Soil conservation : contour trenches, terracing, contour bunds, boulder checks, gabion structures and spring sheds

(H) Flood prevention and protection, drainage for swampy land

(H) All season roads and bridges over streams for rural areas

(K) Other works approved by the Central Government in consultation with the State Governments

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(L) Maintenance of works done under this scheme and protection of area of afforestation

Standardized plans for all these works will be prepared at district level and provided to Gram Panchayats and other implementing corporations.

The Gram Sabha has the right to select the works and decide for which land-water-agricultural area these plans should be prepared. The PBR process can then include the selection of appropriate works for degraded land, planning for them with the help of standardized plans provided by the district level, calculating how many labor will be required and how many men and women will be employed.

(4) Agriculture-Horticulture: In the context of agricultural land, there can be four types of activities in the PBR process: conservation of traditional varieties, conservation of wild plants in the agricultural land, adoption of environmentally friendly practices and creation of water supply facilities and soil conservation through NREGS.

Under the Protection of Plant Varieties and Farmers' Rights Act, farmers can now register their traditional as well as newly developed varieties like HMT rice. Farmers who preserve traditional cultivars can also get special

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grants from the National Gene Fund as farmer-conservator. Therefore, as part of the PBR process, information on all the different

varieties of cultivated plants should be recorded. Their similarities with other cultivars should be noted and the characteristics of those cultivars should be recorded. Special efforts should be made to contact the office of Plant Varieties Registrar of the Government of India and register these records with them and get the deserving farmers recognized as farmer-conservators and a grant for the same.

Many species grow naturally in the agricultural land which are useful to humans such as leafy vegetables like Amaranth and other vegetables like Cucurbit. In particular, some of these leafy vegetables are found to be highly nutritious. Fish and prawns that grow in paddy fields are also highly nutritious. The PBR process can help in recording and assisting in the conservation and utilization of this biodiversity linked to agriculture. One of the objectives of the PBR process is to encourage sustainable farming. This entails careful water use, good use of soil nutrients, especially use of organic fertilizers and use of biological control instead of chemical pesticides.

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Depending on the local situation and the help of those who are knowledgeable in the field, we can enter into the depth in these issues.

An experiment was done in Karnataka, which is worth mentioning. It was conducted by ecologists at the Indian Institute of Science, Bengaluru and experts in crop disease and biological pest control at the Project Directorate of Biological Control, teachers from five schools in Bengaluru and Tumkur districts, and farmers from these five villages. The harmful pest and fungi types infecting the main crops of the village (groundnut, pigeon pea, tomato, okra, cabbage) were recorded through PBR. Viruses, microorganisms and parasitic flies as effective biological controllers for them were selected. The students of the school were trained to develop these control agents as a science project in the school itself. After growing them in large number in the school they were transferred to the farms. Farmers and students tested their effectiveness. Four of the five control agents proved to be very useful.

As a part of the PBR, the work which is permitted to be carried out on the private lands of the farmers under the National Rural Employment Guarantee Scheme, can be systematically planned in the manner suggested for the sparse-bushy-rocky land as above.

(5) Forest: We are left with good forest in small proportion and most of it is included in wildlife sanctuaries or national parks. Today's law prohibits

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people from using anything in the wildlife area. But the blanket ban will be lifted as per the Forest Rights Act. According to the law, the "fragile habitat of wildlife" in all wildlife areas will be redefined on the basis of scientific, objective criteria. Following information about all such places will be collected.

(A) Physical, geographical and ecological details, maps

(B) Places of human settlements, details of their population, social and economic status.

(C) List of families and settlements to be relocated after declaring fragile habitat.

(D) Details of biodiversity, especially the numbers of important flora and fauna, their habitats, and the reasons for changes in their habitats.

(F) Evaluation of the conflict between humans and wildlife, and impact of humans on wildlife habitat

(G) Assessment of local people's dependence on forest resources and its impact on forest resources.

It is the responsibility of the government to collect all this information and provide it to the concerned gramsabhas. Gramsabhas have been given the power to scrutinize this information and collect supplementary information. Regretfully, this has been totally sabotaged. But we must question this by examining such evidence with further study through PBR. The PBR should also record the damages caused to agriculture by wild animals and birds, the

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loss to livestock, death of humans, the measures taken and the compensation received from the government.

(6) Habitation, cities: Natural resources have a place even in densely populated areas. For example, in the center of the city of Pune, Mula-Mutha rivers flow, there is a lake called Pashan, there are hills like Parvati, Vetar, Chatushrunji surrounded by thickly populated areas. Study of these landscapes-waterscapes, recording systematically flora and fauna in the area and preparation of far-sighted plan to protect them can be done through the PBR process.

Apart from such patches, nature conservation is also possible elsewhere - in the open spaces in industrial establishments, schools, colleges, in premises of different institutions and even roadsides. There is a tendency to grow grassy lawns and exotic trees like Gulmohor and Eucalyptus in such spaces. Instead we may grow indigenous and very attractive trees like Amaltash or yellow Indian laburnum and Semal or silk cotton and keystone resource trees like Gular or cluster fig. The PBR process can help in planning and monitoring creation of such biodiversity rich environment in various premises and roadsides.

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Even in absence of open spaces in densely populated areas, there are open terraces of buildings. Due to negligence, water puddles on these terraces simply become breeding places for mosquitoes. The biodiversity tends to be limited to naturally grown pipal trees and pigeons. But it is also possible to create beautiful gardens on these terraces, attracting butterflies and birds. In cities, study and planning for this can be done through PBR.

Some species are particularly sensitive to pollution. Some species of lichen which grow on tree trunks are destroyed when air pollution is high, while insects called chironomids thrive in highly polluted water. Through the study of such indicator species, useful information for environmental planning can be gathered through PBR.

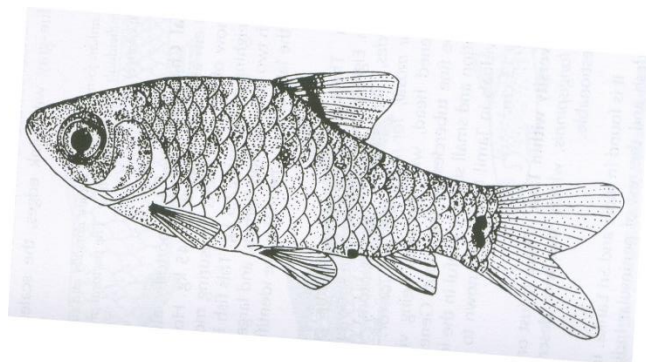
There could be outbreak of disease spreading species like mosquito near thickly populated areas. Study of their habitat, breeding grounds, conditions under which they breed, how to control them should be done through PBR.

Cities consume huge amount of food, energy and various commodities, producing tons of waste. Organic waste can be separated and composted to produce biogas from it. The study of organic material imports in the city as a whole, their use, their further flow, generation of waste from discarded products, disposal or utilization of that waste is a matter of great interest to PBR.



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( 7 ) Fresh waterflows and reservoirs : All the waterbodies - Streams



, rivers , ponds , dams , canals -  
are important for health of the  
environment and add to the natural  
beauty. They are affected as  
follows-

( a ) Sources of water flowing into rivers and lakes are  
obstructed thereby blocking their natural water sources.

( b ) Extensive use of water are drying up riverflows and  
reservoirs

( c ) Construction of bunds and dams indiscriminately are  
obstructing the river flows.

( d ) Flow of sewage, pesticides, effluents from factories and  
hospital-waste into natural streams are increasing the pollution.

( e ) Characteristic vegetation on the banks of rivers and reservoirs is  
destroyed extensively .

( f ) Excessive fishing has caused vanishing of many fish species and  
others are depleted.

( g ) Fishing by using explosives and poisons has caused harm  
to the aquatic life tremendously.

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( h ) Exotics like the fish tilapia and aquatic plants like water hyacinth have thrived and harmed the waterbodies and aquatic life.

Very scanty information is available on such issues and detailed and locality specific information can be collected through PBR. As per Tribal Self-Rule and Forest Rights Act local tribals have rights over the reservoirs and fish - shrimp - crabs etc. As such systematic study of the status and uses of these resources and its long term planning will be a subject matter of PBR.

( 8 ) Marine resources: Like rivers and lakes, marine resources are getting damaged greatly.

( a ) Streams flowing into the sea are obstructed

( b ) Sewage, pesticides, effluents from factories, hospitals wastet and oil drained from ships are contributing largely to the pollution.

(c) Mangroves on the shore and other characteristic vegetation, coral and other aquatic life is disappearing.

(d) Because of overfishing many fish species are vanishing and others are depleting.

We have scanty knowledge of marine ecosystem and sea life. This information may be gathered in details through PBR process.

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(9) Groundwater: Due to unlimited use of ground water the storage is getting depleted. The level of ground water is getting deeper and deeper and ground water pollution is also very important issue. Detailed information about these can be collected through PBR.

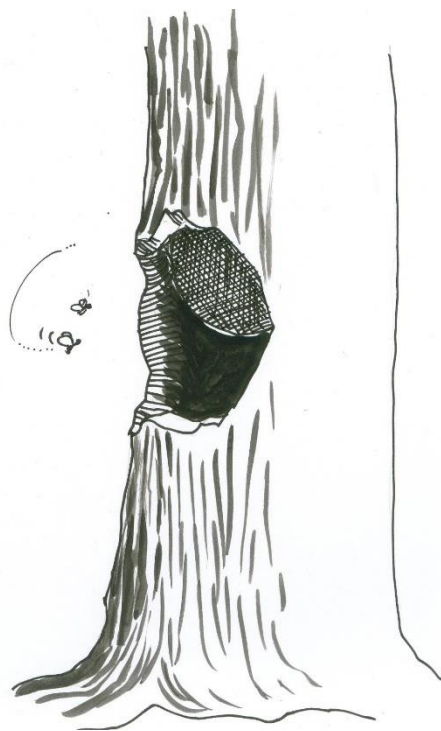
### 4.19 Habitat of living beings

Tigers are hunted in the absence of forest, and a forest is felled if it has no tiger. Hence tigers should protect the forest and forest should support the tigers.

- Mahabharat

The study, which focuses on landscape and waterscape, will provide a wealth of information on wild and cultivated/ domesticated

species. Physical observations of landscape and waterscape elements will give us an idea of the occurrence of all the important species. This would facilitate identifying for a particular species which is the best habitat, which is medium, which is inferior and which is even useless. For example, from the point of view of bird *Lapwing*, grassland, scrubland, especially that which is in the vicinity of streams and ponds is the best habitat and the forest is



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the worst habitat whereas for a woodpecker we will find the opposite. This information is important for future management. Because if we want to try to develop the ecosystem, we have to choose the species that are suitable for that particular habitat.

In order to get a complete picture of the living beings, it is necessary to gather information from experienced people as well in addition to direct observations. At times, a habitat may be perfectly suitable for a species, but still it might have vanished. This is because of overuse or pressure of commercial exploitation. For example, *Narkya*, a tree valued as a source of anti-cancer chemicals has recently disappeared from the forests of Maharashtra, but experienced people tell us that it grows well there. Based on this information, attempts may be made to grow seedlings and replant them.

### 4.20 Documents

The time and locality dependent information compiled from site observations and interactions with experienced people would help in planning and managing natural resources. In addition, other sources of information like documents need to be considered. These will be of two types, scientific and governmental. Methods of systematic use of different species in scientific

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literature may be found, e.g. information on gum removal from *Dhawada* without causing much damage to the tree or the properties of this gum or its value addition process. Government literature may include proposals on the use of *Dhawada* in local forest working plans, restrictions on the sale of gum or the market value of gum. As much as possible, information for such important resources of the village should be compiled and it should be mentioned as supplementary information to the PBR.

### 5. Various efforts through public participation

#### 5.1 Folk traditions and conservation

We are indebted to forest For soil, water and wind This supports the life. - Chipko slogan
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There were many community based systems of natural resource management active in India in the pre-British times. Of these, the water management systems were permitted to function under the British regime, since irrigated land could be taxed at a higher rate. These collapsed after independence; hence, we have a good understanding of many such water management systems and it is acknowledged that a number of them were highly efficient. But there is little understanding of the community based forest management systems of the pre-British times. These were all declared illegitimate on the conquest of the British East India Company and there were systematic attempts to discredit and disband them. But there are some exceptions. For instance, Collins, an officer enquiring into forest grievances of Uttara Kannada district of Karnataka - then Karwar district of Bombay Presidency - in 1922, has special praise for three villages, Halakar,

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Chitrangi and Muroor-Kallabbe. He reports that these villages have been managing their village forests exceedingly well for decades, and have set an example that should be widely emulated. In the Central Provinces, too many villages earlier granted Nistar rights over local forests have been managing them well, even to this day. In Rajasthan the village forests in form of “Orans” were very well managed till the abolition of landlordism after independence. In Goa the local communities had maintained “gavkari” or community forests in good shape during the Portuguese regime. To this day, many communities of Nagaland are managing their own forest resources very efficiently and sustainably.

Hunting of the wildlife too was often well regulated. The nomadic hunting tribe of Phaselpardhis always released pregnant does of deer and antelopes caught in their snares. The fisherfolk had the tradition of refraining from fishing during the upstream spawning runs that take place with the first floods on the onset of the monsoon.

### (1) Traditions of nature conservation

Indian culture has a proud heritage of manifold traditions of nature conservation. Much of our countryside is dotted with banyan, peepal, gular and other trees belonging to genus *Ficus*, protected because they are venerated as sacred trees. Today ecologists consider them as “keystone resources” because they bear fleshy fruits in seasons when no other trees are in fruit, and thereby sustain a diversity of insects, birds, bats, squirrels and monkeys. Science therefore rates them as of high conservation value. This wisdom has been a part of our age old traditions.

Francis Buchanan, a surgeon with East India Company entrusted to survey the newly conquered lands of Tipu Sultan in 1801, writes of a village

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near Karwar: "The forests are property of the gods of the villages in which they are situated, and the trees ought not to be cut without having obtained leave from the headman of the village, whose office is hereditary, and who here also is priest to the village god. The idol receives nothing for granting this permission; but the neglect of this ceremony of asking his leave brings his vengeance on the guilty person. This seems, therefore, merely a contrivance to prevent the government from claiming the property." Quite to the contrary, Dietrich Brandis laments, in 1882, the destruction of the once extensive network of India's sacred groves under the British rule. He had particular praise in store for the sacred groves of Coorg (Gadgil, M. and Guha, R. 1992).

Villages of Alwar district in Rajasthan traditionally established groves in all four directions in their vicinity. The Kankadabani was dedicated to fulfillment of routine requirements of forest produce; the Rakhatbani was touched in years of famine, the Devabani only when there was great distress, while the Devoranya was never touched, even if the people had to abandon the village. These sacred groves survived till very recent times in the Sorab-Siddapur

Dark wild thickets have seen every  
where

Pair, Khair, Kinjal, Ain have grown  
wildly

Vines spread and get entangled  
everywhere

Monkeys make many mischiefs all  
around

taluks of Karnataka, as well as in the hilly tracts of Manipur. Their studies suggest that at least 10% of India's landmass was once preserved under such sacred groves. This implies that this network was twice as extensive as today's wildlife sanctuaries and national parks. Furthermore, it encompassed the whole range of

vegetation types, and the sacred groves were accessible to people everywhere, in their own neighbourhoods.

Although the system of sacred groves is linked to religious beliefs, people are often quite aware of their material benefits. A sacred grove of Shivandhan Taluk in Raigad district of Maharashtra had been preserved for its giant woody liana of *Entada phaseolides*. People came from long distances for its seeds, used in treating cattle. In Jharkhand bamboo groves have been preserved near village entrances. Often there are no harvests permitted from the sacred groves, but this may be relaxed depending on the circumstances. Thus villagers of Ghol in Velhe taluk of Pune district of Maharashtra reported that the only time tree fellings were permitted in their sacred grove was when the whole village had been burnt down. In other systems, regulated use is permitted. In Orans of Rajasthan grazing is allowed, as is collection of brushwood broken by hand. However, cutting with an iron axe or machete is prohibited. In 1972, villagers of Gani in Shrivardhan taluk of Raigad district of Maharashtra asked us to intervene to stop the felling of their Kalkai grove. They said that the only perennial stream of the locality originated in this grove, and feared that it would dry up if the grove were to be felled.

That is why this tradition has not only persisted in today's context of changing religious perceptions, but is even being revived in some places. The rich network of sacred groves of Mizoram-Manipur degraded in 1950's as roads and trucks reached remote localities and as people converted to Christianity. But then people witnessed ill-effects of this destruction. For instance, in some Gangte villages of Churachandpur district of Manipur people suffered from devastating fires consuming their huts during the slash-and-burn



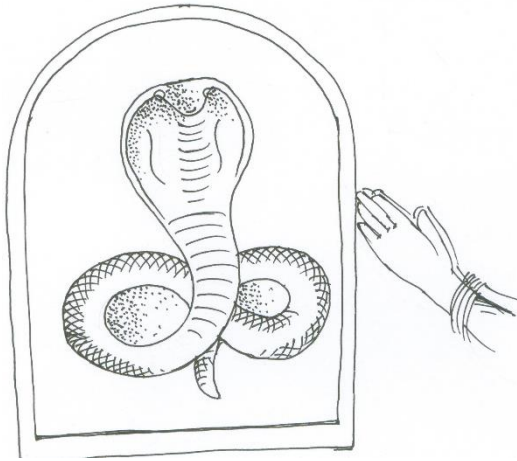
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operations of the shifting cultivation cycle. They then reinstated a circular grove surrounding their habitation to serve as a fire break. Having embraced Christianity, they call this grove a “safety forest”, but its social system of protection has remained unchanged. Even today, the sacred groves play a vital role in conservation of biodiversity. The only patches of natural vegetation surviving today on the thickly settled plains of Kerala are sacred groves dedicated to cobra deities. In one such, the Botanical Survey of India discovered a few years ago, a new species of a climber, *Kunstleria keralensis*. Or consider the giant rainforest tree *Dipterocarpus indicus*, favoured by the plywood industry. When the demand for softwood for this industry escalated, the Karnataka Forest Department made available one species after another at throw-away prices, and despite the claims of sustainable use, these were totally depleted. The result is that today well grown trees of *Dipterocarpus indicus* survive in Karnataka only in Kari Kannamanamane - a sacred grove of the “goddess of dark forest”- in Honnavar taluk of Uttara Kannada district.

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### (2) Controlled use of specific sites:

This is quite possible. The forest panchayats which were established in



Uttarakhand in 1928, made rules on how and to what extent the people should take the forest produce for every day use from the forest, and at many places implementation of sustainable use was achieved e.g. with the formation of

Gopeshwar's Banpanchayat, each family was allowed to take home only one bundle of firewood per week. The ability to constantly monitor the situation and change it accordingly is also possible at the village level.

With the permission of the government, joint forest management was started and forest protection committees were formed voluntarily in thousands of villages in Orissa state. Their experience is remarkable.

One of these villages is Dhani. Starting from 1987, the committee, comprising of 5 neighboring villages, has protected 840 hectares of forest land. The general body meeting of this committee oversees the management as well as takes the responsibility of making rules, resolving disputes and taking action against the offenders and distributing the benefits. This meeting is held once a year. But if something goes wrong or need to change the rules arises, a meeting

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can be called anytime. In the first year after the protection in Dhani was introduced, people or cattle were not allowed to enter in the entire forest. From the second year, grazing was allowed from October to June after the monsoon and also to collect dry wood or leaf litter lying on the ground between July and February. Afterwards, very poor families alone were allowed to collect firewood in small quantities.

The management of Nistar rights in Mendha-Lekha village in Gadchiroli district of Maharashtra is also well managed by the people. They have completely banned the felling of fruit trees in this forest, and have stopped using firewood in the farmland for Raab (burning biomass for ash as a fertilizer). Fishing using poison has been completely stopped in Kathani river of the village. In this way, it is possible to implement well-regulated use of community forest resources across the country.

### (3) Controlled use of specific species:

In addition to the rules of controlled use of specific areas, rules for controlled use of specific species will have to be laid down. Also, a reasonable collection fee for each species - which outsiders will have to pay - will have to be decided. The first large-scale experiment of PBR was started between 1995-97 in seven states. One of them was Nanj,

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on the banks of the Sutlej River in Himachal Pradesh. The Nanj village had done a great job of literacy campaign and as a part of that campaign a board was displayed on the village square. Using this board, the villagers started discussing PBR. Then they realized that the *Rhus wallichii* trees are in bad condition. The tree was used for its green leaf manure and it was chopped badly. As a part of the management set up by the PBR, they decided never to cut off the tips



of the branches of the tree. At the same time, they started experimenting on the use of other leaf litter from as manure. These two experiments stopped the uncontrolled cutting of the *Rhus wallichii* tree and new nice branches started growing and the trees grew fast.

Forest honey is one of the most important forest produce in India. But in most of the places the honey is collected by burning or cutting the entire beehive or sometimes by cutting down large trees. But if you wear a deliberately made protective gear, the bees will not be able to bite, and a honey bearing part of the hive can be cut off so that queen-bee is not harmed. If it is cut in this way, the bees do not change

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their place, and they grow their hive and store honey. This method of extracting honey is practiced in Yerandi village in Gadchiroli district.

### (4) Full protection to specific species:

Like some sites, full protection is given to some species as well. The Bishnoi community in Rajasthan is famous for protecting the *Khejdi*, a tree of acacia family, antelopes and peacocks. Due to the protection of these trees, the villages of Bishnoi are green even in the midst of desert. This *Khejdi* tree has many uses. Its thorny branches are used for fencing, pods feed goats and sheep and leaves are used as green manure. There is no straightforward use of antelope, but it is Bishnois who have stopped many hunters like Salman Khan at the cost of their life. The same protection has been given to Banyan-Pipal-amlā trees and monkeys all over the country.

### (5) Conservation:

Along with protection and regular use, natural resources should be conserved and augmented. Now a days the practice of releasing external fish fry in the pond has become widespread. This fry is often not of good quality. The practice of deliberately going to Bengal and bring quality fish fry for the forest ponds has been started by the people of Mendha-lekha. Lest these fish are caught before they grow properly, the people have made it a custom to worship the pond on *Akshayya Tertiya* (the third day of the month *Vaishakh* as per Indian calendar) and then catch the fish and distribute it evenly in the village.

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The expectations of the locals are clear about what kind of trees are needed in the forest. They want multi-purpose species like Sal, Tendu, Mahua, Ber, Bamboo, Amla. If they are given training on how to make seedlings and how to grow them, they will do this diligently. Through a project called *Wadi*, BAIF has successfully done the experiment of planting mango and other fruit trees in the tribal areas. Thus they will definitely take part in the experiments of growing other wild plants.

### 5.2 Value addition and sale



Along with regulation and conservation, information that will be useful for value addition and information regarding the demand supply chain should be gathered and made available through PBR process and database. Vivekananda Girijan Kalyan Kendra and ATREE have done good experiments with the people of Soliga of Belagiri Rangan Betta in Mysore district. The experiments included preparation of jam and other recipes from Amla, to make medicine from medicinal herbs, to make couch-chair tables from bushy plants like

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Lantana. Recording such experiences in different PBR databases and compiling information from scientific institutes would be beneficial to all.

### 5.3 People's Science and market

The one who knows  
thirst-hunger of trees,  
language of birds,  
gesture of ants  
and the underground water flows  
I have no hesitation in calling  
her/him divine.  
- Indrajit Bhalerao (Pera)

Finally, a controversial topic is the people's knowledge that can be used commercially; e.g., medicinal uses of plants. One of the purposes of the Biodiversity Act is to ensure that people get a just share in profit

if such knowledge is used for commercial purposes. The knowledge of the tribal community of Kani in Kerala that the plant (*Trichopus zelanicus*) has fatigue-relieving property is the only example of sharing of profit by the commercial user with the tribals. When scientists from the Tropical Botanical Gardens and Research Institute (TBGR) learned about this from the people, they did more research and developed a tonic called "*Jivani*". A pharmaceutical company *Arya Vaidyashala* paid Rs 10 lakh to TBGR in return for the right to manufacture *Jivani*. The organization set up a Trust of Kani people and handed over the fund of Rs 5 lakh to the Trust.

These incidents preceded the passage of the Biodiversity Act, and there were some difficulties. For example, the Kani community is in Kerala as well as in neighboring Tamil Nadu. They may also have this knowledge. They

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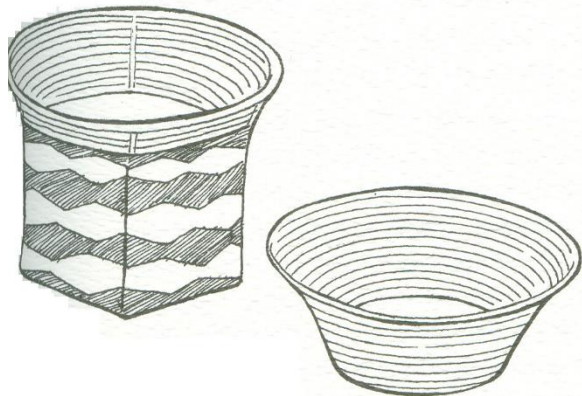
have not received any share from this. It is not impossible for some other communities to have this knowledge. So why shouldn't they also get benefit ?

If we want to find some way out of this, we should have complete records of who knows what. But such records should be kept confidential so as not to be taken advantage of. Only those who have met the conditions set by the knowledge holders should be allowed to view this document. Such an official arrangement is not yet in place. But National Innovation Foundation (NIF) has taken steps in this direction. This institute has been set up by the Government of India with the objective of recording the knowledge of the people and further developing and utilizing that knowledge. The NIF is headed by the head of the Council of Scientific and Industrial Research, Government of India. This organization has created a National Register of People's Knowledge. It has two parts, open and confidential. People who have useful knowledge, but who want to keep it confidential, can submit such knowledge for confidential registration. A list of such confidential knowledge is published. That list does not give details but it is mentioned that one Somaji Gomaji has medicine for snake bites. If a pharmaceutical enterprise wants the details, they are told on what terms Somaji is willing to share his knowledge for use. If these conditions are met, NIF facilitates the signing of an agreement between Somaji and the enterprise.



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NIF can play this role in the context of PBR. As an experiment in this



regard, eight experienced traditional healers from a village called Mala in Karnataka recorded their knowledge and submitted it to NIF for registration as part of a confidential section of NIF's National Register. While handing

over, NIF and these eight persons signed an agreement. The draft agreement was discussed in the Gram Sabha and finalized with the consent of the Gram Sabha. The agreement was signed by the eight knowledge holders and NIF representatives in another Gramsabha meeting, witnessed by Gram Panchayat members.

Perversely, 2004 Rules under Biodiversity Act demand compulsory disclosure of such vital information. This must be resisted and no such information should be recorded as a part of PBR. Of course, recording such knowledge is only a part of PBR's work. Establishing rights over natural resources, its protection, sustainable use and conservation of these resources are equally important. PBR can definitely be used in that context.

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### 5.4 Management Plan

We are steadily moving towards democratic decentralization beginning in 1991 with 73<sup>rd</sup> and 74<sup>th</sup> Amendments to the Constitution. Extension of Panchayat Raj to Scheduled Areas (PESA) Act of 1995 conferred rights to Gramsabha on minor forest produce, minor minerals, reservoirs and fish and other aquatic animals. The Biodiversity Act empowered the Panchayat to regulate all of biodiversity - natural as well as that of cultivated plants and domesticated animals and to levy collection charges from outsiders. In 2006 the Forest Rights Act has also given community rights over forest resources, and it clearly mentions bamboo, tendu cane, honey, shellack, firewood, tussar silk, tubers, and medicinal plants among them. The National Employment Guarantee Act also gives the Gramsabha the right to plan for the conservation of all these natural resources. PBR can be a great help in these planning initiatives.

We are indebted to forest  
For soil, water and wind  
This supports the life.  
- Chipko slogan

There are many aspects of planning. Planning can be about specific (1) sites or (2) species. It could be about human intervention, especially the consumption of certain resources, their harvesting, how and to what extent it is permissible to do so. It will also be about efforts for conserving, maintaining and rejuvenating resources. In addition, the planning could be about processing, value addition and marketing of resources through local

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efforts. In particular, the government is bound to help the Gramsabha to prevent anyone from violating the rules set by the Gramsabha, and it is the duty of the government to give full cooperation to the Gramsabha in exercising its rights.

We propose that out of the overall micro plan for the village, Biodiversity Management Committee (BMC) should take a lead in planning for natural resources and the chairperson of the BMC should be facilitator for this exercise

Involvement of all the stakeholders in the planning process including the elected representative should be encouraged. The focal issues which were listed during the PBR process should be discussed in a meeting of Gramsabha where the elected representatives and members of various user-groups are present. Apart from the focal issues listed in PBR, other problems which the members may be facing should also be discussed. In the meeting, they should prioritize the issues and problems and then deliberate on the solutions. For addressing the issues, the data collected in PBR will be of immense importance. For example, suppose it is decided to plant fruit trees like Amla and Custard Apple. Then the information from the PBR on characteristics and status of various landscape elements and the user-groups associated with them can help in taking the decision where the plantations could be more successful. In another example, if the issue of

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depletion of certain fish species is to be addressed then the data on the history of the waterbody regarding abundance of different fish species and changes made/occurred in the waterbody in the past will be helpful in arriving at the solution of the issue.

While finalizing a management plan, it would be appropriate for the village or mohalla sabha to take a decision unanimously as far as possible. Such decision should keep in view the aspirations and interests of all the user groups in the community. For this, suggestions regarding the management from individuals and user groups with different interests and aspirations should be noted, compiled and brought before the village or mohalla meeting. All these must be taken on board while taking the final decision.

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